

A WIDOW'S LIFE

WILDCATS

BIRTH OF BOOZE

NATIONAL GEOGRAPHIC

SAVING OUR OCEANS



FEBRUARY 2017

Help end the global water crisis.



1 Limited Edition Chalice = 5 Years Clean Water

Water is essential to the lives we live, and an essential part of our heritage of making Stella Artois. It's not something we take for granted. Every day, women in the developing world spend millions of hours collecting water. Imagine what they could do if they didn't have to.

Learn more at BuyALadyADrink.com

StellaArtois.com
ENJOY RESPONSIBLY

© 2016 Anheuser-Busch InBev S.A., Stella Artois® Beer, Imported by Import Brands Alliance, St. Louis, MO



Be Legacy



| CONTENTS

FEBRUARY 2017 • VOL. 231 • NO. 2 • OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

DEPARTMENTS

3 QUESTIONS

Sebastian Junger on the impacts of war

VISIONS

EXPLORE

What we eat, what we wish we could eat, and why eating bugs isn't so bad

STARTALK

From asteroids to zombies with Whoopi Goldberg and Neil deGrasse Tyson



On the Cover

A California sea lion glides below a canopy of kelp at Cortes Bank, a seamount in the Pacific roughly 110 miles west of San Diego.

Photo by Brian Skerry

Corrections and Clarifications

Go to ngm.com/corrections.

FEATURES

30 | A 9,000-YEAR LOVE AFFAIR

Alcohol is one of the most universally produced and enjoyed substances in history, and it has helped shape who we are.

By Andrew Curry Photographs by Brian Finke



A fifth-century B.C. Greek drinking cup depicts an after-dinner drinking party, known as a symposium.

104 | SHADOW CATS

Small cats – like the marbled cat below – are skilled at avoiding notice. But they're beginning to draw the attention of conservationists and researchers.

By Christine Dell'Amore

Photographs by Joel Sartore



54 | SAVING THE SEAS

Although President Obama granted protected status to 850,000 square miles of ocean, there's still more to do.

By Cynthia Barnett

Photographs by Brian Skerry

78 | LIFE AFTER LOSS

Societies can impose new burdens and limits on women after their husbands die.

By Cynthia Gorney

Photographs by Amy Toensing

120 | MODERN AMAZONIA

In the jungle today, real people face the clash of tribal lore and modern lure.

Story and Photographs by Yann Gross

CONTENTS

ELSEWHERE

TELEVISION

THE STORY OF GOD RETURNS WITH NEW EPISODES

What do we believe about heaven and hell, or the Chosen One? Morgan Freeman explores those questions and more in his popular National Geographic series, Mondays at 9/8c starting January 16.

BOOKS

SEE THE U.S.A. THROUGH OUR PHOTO ARCHIVES



A skier gazes across the Rocky Mountains in a 1953 photo by Charles Grover. It's just one of dozens of archetypal photographs in the new book *The United States of America: A Pictorial History of the USA Through the National Geographic Archives*. Art book publisher Taschen mined the magazine's archives to create a one-of-a-kind portrait of the United States. The two-volume set is available at shopng.com or wherever books are sold.

TELEVISION

DOCUMENTARY SHOWS 'HELL ON EARTH' IN SYRIA

Through the lens of his own experiences as a war reporter, Sebastian Junger examines the violence that has turned millions of Syrians into refugees. The documentary *Hell on Earth: The Fall of Syria and the Rise of ISIS* airs Sunday, March 12, at 9/8c on National Geographic.

NATGEO.COM INTERACTIVE

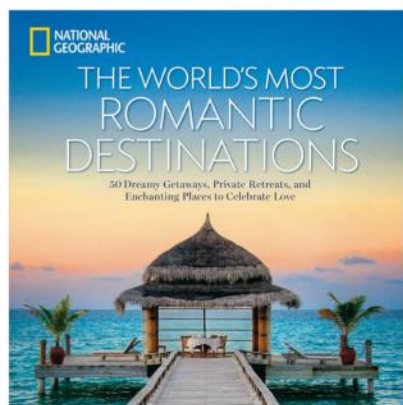
UNDERSEA 360° VIDEO

Plunge beneath the waves with *National Geographic* photographer Brian Skerry to explore Buck Island Reef National Monument in the Caribbean. Find the 360° video of this Virgin Islands reef and its remarkable creatures at natgeo.com/buckisland.

BOOKS

GETAWAYS FOR VALENTINES

From beaches and spas to an ocean-view restaurant in Big Sur, California, 50 great escapes beckon from the pages of National Geographic's *The World's Most Romantic Destinations*. Full of photos and travel tips, it's available at shopng.com or wherever books are sold.



TELEVISION

THINK YOUR HOUSE CAT IS TAME? BETTER THINK AGAIN ...

Big Cat Week – celebrating wild beasts that are beautiful, strong, and facing extinction – kicks off February 20 on Nat Geo WILD. The fiercest big cats share lineage with today's domestic cats. See what else they have in common in *Soul of the Cat*, February 22 at 10/9c on Nat Geo WILD.

Subscriptions For subscriptions or changes of address, contact Customer Service at ngmservice.com or call 1-800-647-5463. Outside the U.S. or Canada call +1-813-979-6845. We occasionally make our subscriber names available to companies whose products or services might be of interest to you. If you prefer not to be included, you may request that your name be removed from promotion lists by calling 1-800-NGS-LINE (647-5463). To prevent your name from being available to all direct mail companies, contact: Mail Preferences Service, c/o Direct Marketing Association, P.O. Box 9008, Farmingdale, NY 11735-9008.

Contributions to the National Geographic Society are tax deductible under Section 501(c)(3) of the U.S. tax code. | Copyright © 2017 National Geographic Partners, LLC | All rights reserved. National Geographic and Yellow Border: Registered Trademarks ® Marcas Registradas. National Geographic assumes no responsibility for unsolicited materials. Printed in U.S.A.

NATIONAL GEOGRAPHIC (ISSN 0027-9358) PUBLISHED MONTHLY BY NATIONAL GEOGRAPHIC PARTNERS, LLC, 1145 17TH ST. NW, WASHINGTON, DC 20036. ONE YEAR MEMBERSHIP: \$39.00 U.S. DELIVERY, \$44.00 TO CANADA, \$51.00 TO INTERNATIONAL ADDRESSES. SINGLE ISSUE: \$7.00 U.S. DELIVERY, \$10.00 CANADA, \$15.00 INTERNATIONAL. (ALL PRICES IN U.S. FUNDS, INCLUDES SHIPPING AND HANDLING) PERIODICALS POSTAGE PAID AT WASHINGTON, DC, AND ADDITIONAL MAILING OFFICES. POSTMASTER: SEND ADDRESS CHANGES TO NATIONAL GEOGRAPHIC, P.O. BOX 62130, TAMPA, FL 33662. IN CANADA, AGREEMENT NUMBER 40063649, RETURN UNDELIVERABLE ADDRESSES TO NATIONAL GEOGRAPHIC, P.O. BOX 4412, STN. A, TORONTO, ONTARIO M5W 3W2. UNITED KINGDOM NEWSSTAND PRICE £5.99. REPR. EN FRANCE: EMD FRANCE SA, BP 1029, 59011 LILLE CEDEX, TEL. 320.300.302, CPPAP 0715U89037. DIRECTEUR PUBLICATION: D. TASSINARI DIR. RESP. ITALY: RAPP. IMD SRL, VIA G. DA VELATE 11, 20162 MILANO; AUT. TRIB. MI 258/26/5/84 POSTE ITALIANE SPA; SPED. ABB. POST. DL 353/2003 (CONV. L. 27/02/2004 N.46) ART. 1 C. 1 DCB MILANO STAMPA QUAD/GRAPHICS, MARTINSBURG, WV 25401. MEMBERS: IF THE POSTAL SERVICE ALERTS US THAT YOUR MAGAZINE IS UNDELIVERABLE, WE HAVE NO FURTHER OBLIGATION UNLESS WE RECEIVE A CORRECTED ADDRESS WITHIN TWO YEARS.

BABY BOOMERS

(BORN 1945-1965)

**1 IN 30 HAS HEPATITIS C AND
MOST DON'T EVEN KNOW IT.**

HEP C. THE FORGOTTEN VIRUS.

There's a virus out there that hasn't been talked about much, and you may not have heard about it. A virus that's serious, like HIV. **It's hepatitis C (Hep C).** It can hide in your body for years, even decades, without symptoms. And it isn't tested for in routine blood work. If left untreated, Hep C can cause liver damage and even lead to liver cancer.

The CDC (Centers for Disease Control and Prevention) recommends **all Baby Boomers** get tested for Hep C. All it takes is a simple one-time blood test.

The good news is: **if you have Hep C, it can be cured.** Ask your healthcare provider at your next appointment to be tested for Hep C. It's the only way to know for sure.

FOR US, IT'S TIME TO GET TESTED.

VISIT **HEPCHOPE.COM** OR CALL **844-9-HEPCHOPE.**



HEP C HOPE, KNOW FOR SURE, GILEAD and the GILEAD logo are trademarks of Gilead Sciences, Inc.
All other trademarks referenced herein are the property of their respective owners.
©2016 Gilead Sciences, Inc. All rights reserved. UNBC4089 11/16

HEPC
.....
**KNOW FOR SURE™
GET TESTED**



WHAT WIDOWS LOSE—AND KEEP

About one million American women become widowed each year. For many of us who have been there, it was a singular, searing experience.

But we are the lucky ones: In many parts of the world, losing one's husband is about much more than coping with grief, loneliness, or financial upheaval. A husband's death may plunge a woman into a state of widowhood—enforced by cultural, social, or legal bonds—she cannot leave. Widows are cast out. Their possessions, their land, and even their children can be taken from them.

Photographer Amy Toensing, with a grant from the Pulitzer Center on Crisis Reporting, has publicized widows' plight since she first shot the story in India in 2005. For this article we sent Toensing and writer Cynthia Gorney back to India, as well as to Uganda and to Bosnia and Herzegovina, to continue the project.

They went, as Gorney writes, to understand “the way societies can force a jarring new identity on a woman whose husband has died: pariah, exile, nuisance,

martyr, prey.” Toensing and Gorney found that story—but they also found women of incredible strength fighting generations of repressive tradition.

In Uganda, after Clare Tumushabe's husband died, his relatives told her that they were taking her six children and the land where she grew her family's food—and that she would become the third wife of her husband's oldest brother.

To summarize Tumushabe's answer: no way. She worked with a legal team from a U.S.-based nonprofit called International Justice Mission to make sure Uganda's laws, which prohibit exactly this behavior, were enforced. It was a long and ugly battle, but today Tumushabe has her children and home and isn't in a forced marriage. One of the men who attacked her went to jail.

“I believe that there is hope,” said Alice Muhairwe Mparana, a lawyer who aided Tumushabe. “We are not 100 percent there, but we have begun.” On behalf of the 259 million widows around the world, these are heartening words indeed.

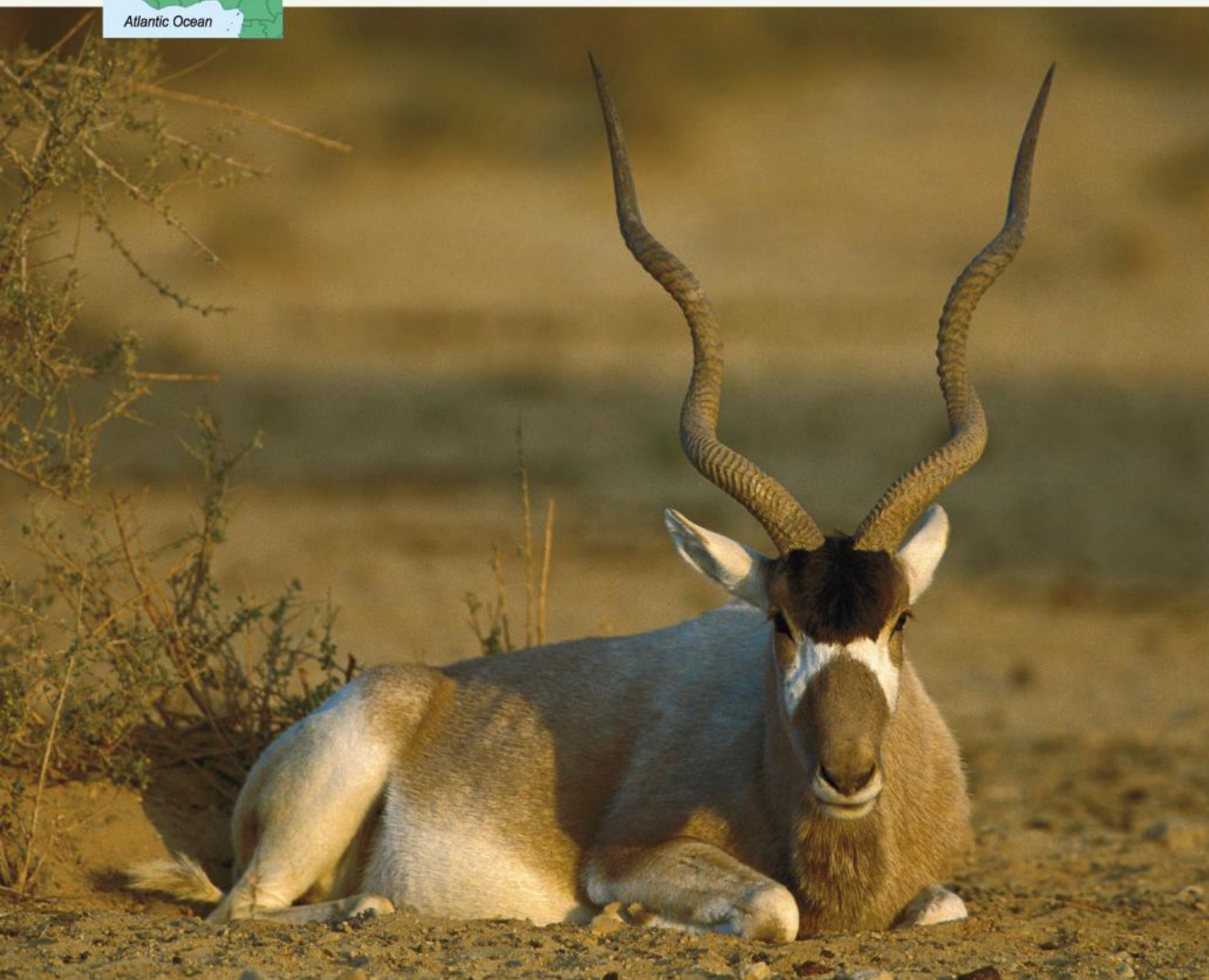
From the day that Clare Tumushabe's husband died, his relatives challenged her right to her home, her cropland, and even her children. But Tumushabe fought back. Here she carries her daughter Jemi-ma as she heads out to plant sweet potatoes near her home in Uganda's Mukono District.

Susan Goldberg, *Editor in Chief*



Addax (*Addax nasomaculatus*)

Size: Body length, 120 - 130 cm (47.2 - 51.2 inches); horn length, 76 - 109 cm (29.9 - 42.9 inches) **Weight:** 81 - 122 kg (179 - 269 lb) **Habitat:** Termit and Tin Toumma region of Niger **Surviving number:** Estimated at fewer than 300; possibly as few as three wild individuals remaining



Photographed by Cyril Ruoso

WILDLIFE AS CANON SEES IT

No water? No problem. Living in the driest desert regions, the addax gets all the moisture it needs from the grasses, forbs and bush leaves it consumes. To minimize water loss from heat evaporation, the addax huddles in the shade of shrubs during the day; on cool nights it lies in hollows to help dissipate body heat. Nomadic groups led by older females were once a

common sight throughout North and Saharan Africa, but widespread poaching and the expansion of non-native livestock have now reduced wild populations to a mere handful.

As Canon sees it, images have the power to raise awareness of the threats facing endangered species and the natural environment, helping us make the world a better place.



EOS System

Canon



We believe in the power of science, exploration, and storytelling to change the world.

EDITOR IN CHIEF Susan Goldberg

DEPUTY EDITOR IN CHIEF: Jamie Shreeve. **MANAGING EDITOR:** David Brindley. **EXECUTIVE EDITOR** DIGITAL: Dan Gilgoff. **DIRECTOR OF PHOTOGRAPHY:** Sarah Leen. **EXECUTIVE EDITOR NEWS AND FEATURES:** David Lindsey. **CREATIVE DIRECTOR:** Emmet Smith

NEWS/FEATURES **SHORT-FORM DIRECTOR:** Patricia Edmonds. **DEPUTY NEWS DIRECTOR:** Gabe Bullard. **EDITORS:** Maria Cone, Christine Dell'Amore, Peter Gwin, John Hoeffel, Victoria Jaggard, Robert Kunzig, Glenn Oeland, Oliver Payne. **WRITERS:** Jeremy Berlin, Eve Conant, Michael Greshko, Brian Clark Howard, Becky Little, Laura Parker, Kristin Romey, Rachel Hartigan Shea, Daniel Stone, Mark Strauss, Nina Storchic, A. R. Williams, Catherine Zuckerman. **CONTRIBUTING WRITERS:** Robert Draper, Cynthia Gorney, David Quammen, Craig Welch. **SPECIAL INVESTIGATIONS:** Bryan Christy, Rachael Bale, Jani Actman. **ADMINISTRATION:** Natasha Daly

PHOTOGRAPHY **DEPUTY DIRECTORS:** Whitney C. Johnson, Patrick Witty. **YOUR SHOT DIRECTOR:** Monica C. Corcoran. **BUSINESS MANAGER:** Jenny Trucano. **SENIOR PHOTO EDITORS:** Kathy Moran (*Natural History*), Kurt Mutchler (*Science*); Todd James, Alexa Keele, Sadie Quarrier, Vaughn Wallace, Jessie Wender, Nicole Werbeck. **ASSOCIATE PHOTO EDITORS:** Matt Adams, Mallory Benedict, Adrian Coakley, Janna Dotschkal, Jehan Jillani. **PHOTO PRODUCER:** Jeanne M. Modderman. **ASSISTANT PHOTO EDITORS:** Melody Rowell, Jake Rutherford. **STAFF PHOTOGRAPHERS:** Rebecca Hale, Mark Thieszen. **DIGITAL IMAGING:** Christina Micek, Edward Samuel. **PHOTO COORDINATORS:** Edward Benfield, Lisa Jewell, Elena Shevelko. **ADMINISTRATION:** Veronica Kresse

DESIGN **DIRECTOR:** Michael Tribble. **SENIOR DESIGN EDITORS:** John Baxter, Elaine H. Bradley. **DESIGN EDITOR:** Hannah Tak. **DESIGN SPECIALISTS:** Scott Burkhard, Sandi Owatverot-Nuzzo

ART/GRAPHICS **DIRECTOR:** John Tomiano. **SENIOR GRAPHICS EDITORS:** Fernando G. Baptista, Manuel Canales, Monica Serrano, Jason Treat. **GRAPHICS EDITOR:** Daniela Santamarina (*Production*). **JUNIOR GRAPHICS EDITORS:** Riley Champine, Daisy Chung, Andrew Umentum. **RESEARCHER:** Ryan Williams

CARTOGRAPHY **DIRECTOR:** Damien Saunder. **DIRECTOR OF CARTOGRAPHIC DATABASES:** Theodore A. Sickle. **SENIOR CARTOGRAPHY EDITORS:** Ryan Morris (*Interactives*); Matthew W. Chwastyk. **CARTOGRAPHY EDITORS:** Lauren E. James, Charles A. Preppernau. **MAP EDITOR:** Rosemary P. Wardley. **BUSINESS OPERATIONS SPECIALIST:** Nicole Washington

COPY/RESEARCH **DEPUTY MANAGING EDITOR:** Amy Kolczak. **RESEARCH DIRECTOR:** Alice S. Jones. **COPY EDITORS:** Preeti Aroon, Cindy Leitner, Mary Beth Oelkers-Keegan. **RESEARCHERS:** Elizabeth S. Ataly, Christy Ullrich Barcus, Nora Gallagher, Taryn L. Sallinas, Heidi Schultz, Brad Scriber

DIGITAL PUBLISHING **CREATIVE DIRECTOR:** Bethany Powell. **PROGRAMMING DIRECTOR:** Alissa Swango. **ADVENTURE EDITORIAL DIRECTOR:** Mary Anne Potts. **VIDEO DIRECTOR:** Jarries Williams. **SENIOR BLOGGERS:** April Fulton. **DESIGNERS:** Kevin DiCesare, Chan Young Park, Vitorin Zarkovic. **WEB PRODUCERS:** Janey Adams, Heather Brady, Korina Di Roma, Jess Estepa, April Fahling, Sarah Gibbens, John Kondis, Kat Long, Francis Rivera. **VIDEO PRODUCERS:** Jeff Hetrick; Stephanie Atlas, James Burch, Kathryn Carlson, Gabriella Garcia-Pardo, Will Hallicks, Rachel Link, Nick Lunn, Edythe McNamee, Jennifer Murphy, Jed Winer. **EDITORIAL SERVICES:** Nancy Gupton; Liane DiStefano, Emily Shenk Flory, Brett Weisband. **PRODUCTION MANAGERS:** Lisa Covi, Trish Dorsey. **COORDINATORS:** Rachel Brown, Sandra Oyeneviny

OPERATIONS/FINANCE **ASSISTANT TO EDITOR IN CHIEF:** Joey Wolfkill. **BUSINESS OPERATIONS:** Cole Ingraham; Tracey Franklin, Jacqueline Rowe, Edwin Sakyl. **FINANCE:** Jeannette Swain; Nikisha Long; Allison Bradshaw, Leticia Rivera

COMMUNICATIONS **DIRECTORS:** Ann Day, Anna Kukulhaus Dynan. **NATIONAL GEOGRAPHIC CREATIVE VICE PRESIDENT:** Alice Keating, Mimi Domack, Stacy Gold, John Rutter. **CONTENT STRATEGY VICE PRESIDENT:** Dave E. Smith. **SENIOR BUSINESS ANALYST:** Gina L. Cicotello. **SYSTEMS:** Robert Giroux, Patrick Twomey

CONSUMER MARKETING **EXECUTIVE VICE PRESIDENT:** Terrence Day. **SENIOR VICE PRESIDENT MEMBER MARKETING:** Elizabeth M. Safford. **VICE PRESIDENTS:** John MacKethan, John A. Seeley. **DIRECTORS:** Anne Barker, Richard Brown, Tracy Pelt

PRODUCTION SERVICES **SENIOR VICE PRESIDENT:** Philip L. Schlosser. **IMAGING VICE PRESIDENT:** Thomas J. Craig; Wendy K. Smith; Rahsaan J. Jackson. **QUALITY TECHNICAL DIRECTOR:** Clayton R. Burneston; Michael G. Lappin, William D. Reicherts. **DISTRIBUTION AND ADVERTISING PRODUCTION:** Kristin M. Semenluk. **BUSINESS MAGAZINE DIRECTOR:** Greg Storer

INTERNATIONAL EDITIONS **DEPUTY EDITORIAL DIRECTOR:** Darren Smith. **MULTIMEDIA EDITOR:** Laura L. Toraldo. **PRODUCTION SPECIALIST:** Beata Kovacs Nas

EDITORS **ARABIC:** Alsaad Omar Almenhaly. **BRAZIL:** Ronaldo Ribeiro. **BULGARIA:** Krassimir Drumev. **CHINA:** Ai Shaoqiang. **CROATIA:** Hrvoje Prčić. **CZECHIA:** Tomáš Tureček. **ESTONIA:** Erkki Peetsalu. **FARSI:** Babak Nikkhah Bahrami. **FRANCE:** Jean-Pierre Vignaud. **GEORGIA:** Levan Butkhuzi. **GERMANY:** Florian Gless. **HUNGARY:** Tamás Vilray. **INDIA:** Niloufer Verkhatriaman. **INDONESIA:** Didi Kaspri Kasim. **ISRAEL:** Daphne Raz. **ITALY:** Marco Cattaneo. **JAPAN:** Shigeo Otsuka. **KAZAKHSTAN:** Yerkin Zhakipov. **KOREA:** Junemo Kim. **LATIN AMERICA:** Claudia Muzzi Turullols. **LITHUANIA:** Frederikas Janosnas. **NETHERLANDS/BELGIUM:** Art Aarsbergen. **NORDIC COUNTRIES:** Karen Gunn. **POLAND:** Martyna Wojciechowska. **PORTUGAL:** Gonçalo Pereira. **ROMANIA:** Catalin Grui. **RUSSIA:** Andrey Palamarchuk. **SERBIA:** Igor Rill. **SLOVENIA:** Marjia Javornik. **SPAIN:** Josep Cabello. **TAIWAN:** Yungshih Lee. **THAILAND:** Kowit Phadungruangkij. **TURKEY:** Nesibe Bat

NATIONAL GEOGRAPHIC SOCIETY

PRESIDENT AND CEO Gary E. Knell

BOARD OF TRUSTEES

CHAIRMAN: Jean N. Case
VICE CHAIRMAN: Tracy R. Wolstencroft

Wanda M. Austin, Brendan P. Bechtel, Michael R. Bonsignore, Alexandra Grosvenor Eller, William R. Harvey, Gary E. Knell, Jane Lubchenco, Mark C. Moore, George Muñoz, Nancy E. Plund, Peter H. Raven, Edward P. Roski, Jr., Frederick J. Ryan, Jr., Ted Waitt, Anthony A. Williams

INTERNATIONAL COUNCIL OF ADVISORS

Darlene T. Anderson, Michael S. Anderson, Sarah Argyropoulos, Lucy and Henry Billingsley, Richard C. Blum, Sheila and Michael Bonsignore, Diane and Hal Brierley, Howard G. Buffett, Pat and Keith Campbell, Jean and Steve Case, Alice and David Court, Barbara and Steve Durham, Juliet C. Folger, Michael J. Fourtco, Warren H. Haruki, Joan and David Hill, Lyda Hill, David H. Koch, Deborah M. Lehr, Sven Lindblad, Juli and Tom Lindquist, Jho Low, Claudia Madrazo de Hernández, Pamela Mars Wright, Edith McBean, Susan and Craig McCaw, Mary and Gregory M. Moga III, Mark C. Moore, Pearl and Seymour Moskowitz, Timothy S. Nash, Caryl D. Philips, Mark Pruzanski, Gayle and Edward P. Roski, Jr., Jeannie and Tom Rutherford, Victoria Sant, Donna Socia Seegers, Hugo Shong, Jill and Richard Sideman, Jessica and Richard Snider, Philip Stephenson, Mary Hart and Burt Sugarman, Clara Wu Tsai, Garry Weber, Angie and Leo Wells, Judith and Stephen Wertheimer, Tracy R. Wolstencroft, B. Wu and Eric Larson, Jeffrey M. Zell

RESEARCH AND EXPLORATION COMMITTEE

CHAIRMAN: Peter H. Raven
Paul A. Baker, Kamaljit S. Bawa, Colin A. Chapman, Janet Franklin, Carol P. Harden, Kirk Johnson, Jonathan B. Losos, John O'Loughlin, Steve Palumbi, Naomi E. Pierce, Jeremy A. Sabloff, Monica L. Smith, Thomas B. Smith, Christopher P. Thornton, Wirt H. Wills

EXPLORERS-IN-RESIDENCE

Robert Ballard, Lee R. Berger, James Cameron, Sylvia Earle, J. Michael Fay, Beverly Joubert, Derek Joubert, Louise Leakey, Meave Leakey, Enric Sala

FELLOWS

Dan Buettner, Bryan Christy, Fredrik Hiebert, Zeb Hogan, Corey Jaskolski, Mattias Klum, Thomas Lovejoy, Sarah Parcak, Paul Salopek, Joel Sartore

NATIONAL GEOGRAPHIC PARTNERS

CEO Declan Moore

SENIOR MANAGEMENT

EDITORIAL DIRECTOR: Susan Goldberg
CHIEF FINANCIAL OFFICER: Marcela Martin
GLOBAL NETWORKS CEO: Courtney Monroe
CHIEF COMMUNICATIONS OFFICER: Laura Nichols
LEGAL AND BUSINESS AFFAIRS: Jeff Schneider
CHIEF TECHNOLOGY OFFICER: Jonathan Young

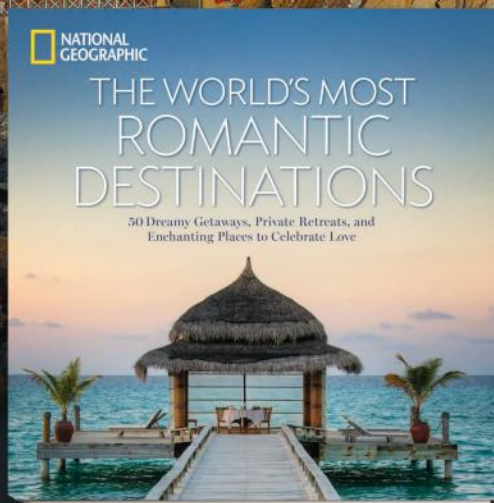
BOARD OF DIRECTORS

CHAIRMAN: Gary E. Knell

Jean N. Case, Randy Freer, Kevin J. Maroni, James Murdoch, Lachlan Murdoch, Peter Rice, Frederick J. Ryan, Jr.

FALL IN LOVE

WITH THESE DREAM GETAWAYS



Discover 50 of the world's most romantic places in this elegant book of vacation inspiration. Captivating photographs and practical tips on traveling to these alluring locales—from secluded beaches to exotic jungles to luxurious spas—offer the perfect passionate escape to those who have just found love or are celebrating a lifetime of it.

AVAILABLE WHEREVER BOOKS ARE SOLD
AND AT NATIONALGEOGRAPHIC.COM/BOOKS



NATGEOBOOKS



@NATGEOBOOKS



© 2017 National Geographic Partners, LLC

HOW WE SHOW ALL SIDES OF WAR

In the National Geographic documentary *Hell on Earth: The Fall of Syria and the Rise of ISIS*, journalist and Oscar-nominated director **Sebastian Junger**, 55, offers a look inside Syria's civil war. His latest book, *Tribe*, is about conflict, homecoming, and Western society's lack of cohesion.

Why did you make a film inside Syria?

No one had shown [this war] from every perspective; I don't know if that's been done in any war. But if we didn't do that, we'd create a film that has bias. Our premise is that ISIS is extremely smart and appealing to people—and if the world has any chance of defeating it, we have to understand why.

Has covering war changed in your life?

There's a specific targeting of journalists today. It used to be hands-off, but now they're being kidnapped and executed in a very public manner. Early on we decided that this is a Syrian story, and we didn't want to put a Western journalist in front of a camera in the middle of someone else's struggle. War reporting is intoxicating and compelling, but it's limiting. When my filming partner Tim Hetherington was killed in Libya, I decided not to directly cover war anymore. My skills are better used in a directorial role than in the back of a truck getting shot at.

How does war change a society?

Twenty years after Sarajevo, one woman told me, "You know, a lot of us miss the war." Humans are drawn to community, and togetherness is a buffer against mental illness. In *Tribe* I wanted to understand why the U.S. military is so effective on the battlefield but has such high rates of PTSD [11 to 20 percent of recent vets have been diagnosed with it], while the Israeli military has one percent. Mandatory national service, with an option to join the military, would help us a lot. It's a question of feeling like you belong to something greater than yourself.

Watch the documentary *Hell on Earth: The Fall of Syria and the Rise of ISIS* on March 12 at 9/8c on National Geographic.



QUICKENLOANS.COM

DON'T GET HELD DOWN BY AN OUTDATED MORTGAGE PROCESS.
GO COMPLETELY ONLINE FOR A FAST, CONVENIENT APPROVAL.

GO WAITLESS



Quicken Loans Inc.; NMLS#3030; www.NMLSCustomerAccess.org; Equal Housing Lender. Licensed in 50 states. AR, TX: 1050 Woodward Ave., Detroit, MI 48226-1906, (888) 474-0404; AZ: 16425 North Pima, Ste. 200, Scottsdale, AZ 85260, Mortgage Banker License #BK-0902939; CA: Licensed by Dept. of Business Oversight, under the CA Residential Mortgage Lending Act and Finance Lenders Law; CO: Regulated by the Division of Real Estate; GA: Residential Mortgage Licensee #11704; IL: Residential Mortgage Licensee #4127 - Dept. of Financial and Professional Regulation; KS: Licensed Mortgage Company MC.0025309; MA: Mortgage Lender License #ML 3030; ME: Supervised Lender License; MN: Not an offer for a rate lock agreement; MS: Licensed by the MS Dept. of Banking and Consumer Finance; NH: Licensed by the NH Banking Dept., #6743MB; NV: License #626; NJ: Licensed Mortgage Banker - NJ Dept. of Banking, 1st (and/or 2nd) mortgages only; NY: Licensed Mortgage Banker - NYS Banking Dept.; OH: MB 850076; OR: License #ML-1387; PA: Licensed as a 1st Mortgage Banker by the Dept. of Banking and licensed pursuant to the PA Secondary Mortgage Loan Act; RI: Licensed Lender; WA: Consumer Loan Company License CL-3030. Rates subject to change. Restrictions may apply. ©2000 - 2016 Quicken Loans Inc. All rights reserved. Lending services provided by Quicken Loans Inc., a subsidiary of Rock Holdings Inc. "Quicken Loans" is a registered service mark of Intuit Inc., used under license.

| VISIONS

Canada

In Manitoba's Wapusk National Park, a polar bear and her four-month-old cub nestle by a willow tree. Hungry mothers and cubs exit their birthing dens each spring – at the same time seal pups are born on pack ice in nearby Hudson Bay.

PHOTO: DAISY GILARDINI









Czechia

Braids of frost adorn beech and spruce trees on a ridge in the West Beskids. The discontinuous range – part of the ecologically important Carpathian Mountains – also spans Poland and Slovakia. This section has been protected since 1973.

PHOTO: JAN BAINAR

Antarctica

What's black and white and bred all over? Pléneau Island, where gentoo penguins mate each spring. Here, a thousand or so of the big, flightless birds — average size: 12 pounds, 2.5 feet tall — get acquainted during a snowstorm.

PHOTO: DAISY GILARDINI





➤ Order prints of select *National Geographic* photos online at [NationalGeographicArt.com](https://www.NationalGeographicArt.com).



CHALLENGE: #YOURPLATE

We want to see your memorable food experiences. The photos will continue to be featured in National Geographic's ongoing food initiative.

Brenda Snape
Aurora, Ontario

After receiving her weekly box of local farm produce, Snape saw a photo opportunity in the vivid colors. She sliced the cucumbers, tomatoes, cauliflower, and leafy vegetables, then arranged them on her light table. She took 38 shots before she prepared the items for their next role: dinner.

THE ROAD TO YOUR
HAPPY PLACE IS PAVED WITH
RAISINS AND FLAKES.
AND PAVEMENT.



EXPLORE

FOOD

ARTISTIC LIBERTY AT THE TABLE

By Nina Storchlic

Social media is an endless feed of food—drawings in cappuccino foam, artfully staged overstuffed hamburgers. This #foodporn craze has surprisingly refined origins—even the old masters partook in the artistic tradition.

In a 2016 study called “Food Art Does Not Reflect Reality,” researchers from Cornell University’s Food and Brand Lab analyzed American and European paintings of family meals between the years 1500 and 2000. The study compared how frequently a food item was depicted in art with how commonly it was consumed. Shellfish, for instance, appeared in a fifth of German paintings, despite the country’s minuscule coastline. Rare delicacies—lobster, artichokes, hazelnuts, and lemons—were particularly popular. This art, they discovered, was used more to flaunt wealth or talent than to display the food actually eaten.

Foodscapes faded in the 20th century but were revived with social media and smartphones. “When there’s pressure to tweet something different all the time, you try to make your life look more exciting,” says Brian Wansink, director of the lab and lead author of the study. “But it’s nothing compared to what they were doing 500 years ago.”





**FROM THE
STUDY**

39%

of paintings
from the age
of exploration
featured
shellfish

28%

of paintings
from the age of
enlightenment
featured
lemons

26%

of paintings
from the age of
enlightenment
featured
grapes



UNITED STATES OF CORN

By Catherine Zuckerman

Food for thought: How does one ingredient become linked to one place?

That's one question artists Henry Hargreaves and Caitlin Levin had in mind when they hatched their "food map" series—a collection of country and continent maps made using ingredients synonymous with those regions. Think India rendered in spices, New Zealand in kiwifruit, South America in citrus.

In some of these cases and in many others around the globe, the foods most commonly associated with a place aren't actually native to that spot. Tomatoes, for example, come from South America, yet today they're an integral part of Italian cuisine. That association began before 1548, says Peter Raven, president

emeritus of the Missouri Botanical Garden, when "the first written account of a tomato outside of the Americas was documented—in Tuscany."

For their map of the United States (above), Hargreaves and Levin chose as their medium an assemblage of corn varieties and corn-derived products. And with good reason: Today no other country produces more of the crop, which made its way north from Mexico some 7,000 years ago and then—thanks to its high adaptability and versatility—proliferated.

Indeed, says Iowa State University agronomist Mark Licht, corn now grows throughout the U.S. in every state from New Hampshire to Hawaii.

An artistic representation of the U.S. features corn in many forms—including cobs, kernels, and chips.

How do we nourish
the world sustainably?
Stay connected.



The future of our food and our planet are deeply connected. When food moves across borders it can be grown in the right climate, using less land and water.

Opening new markets boosts food production, spurs job creation and puts food on more tables around the world. That's why we work to stay connected through trade – to sustainably nourish the world and build local economies that *thrive*. Learn more at [cargill.com](https://www.cargill.com)

thriveTM

FOR CITRUS, IT'S ALL RELATIVE

By Daniel Stone

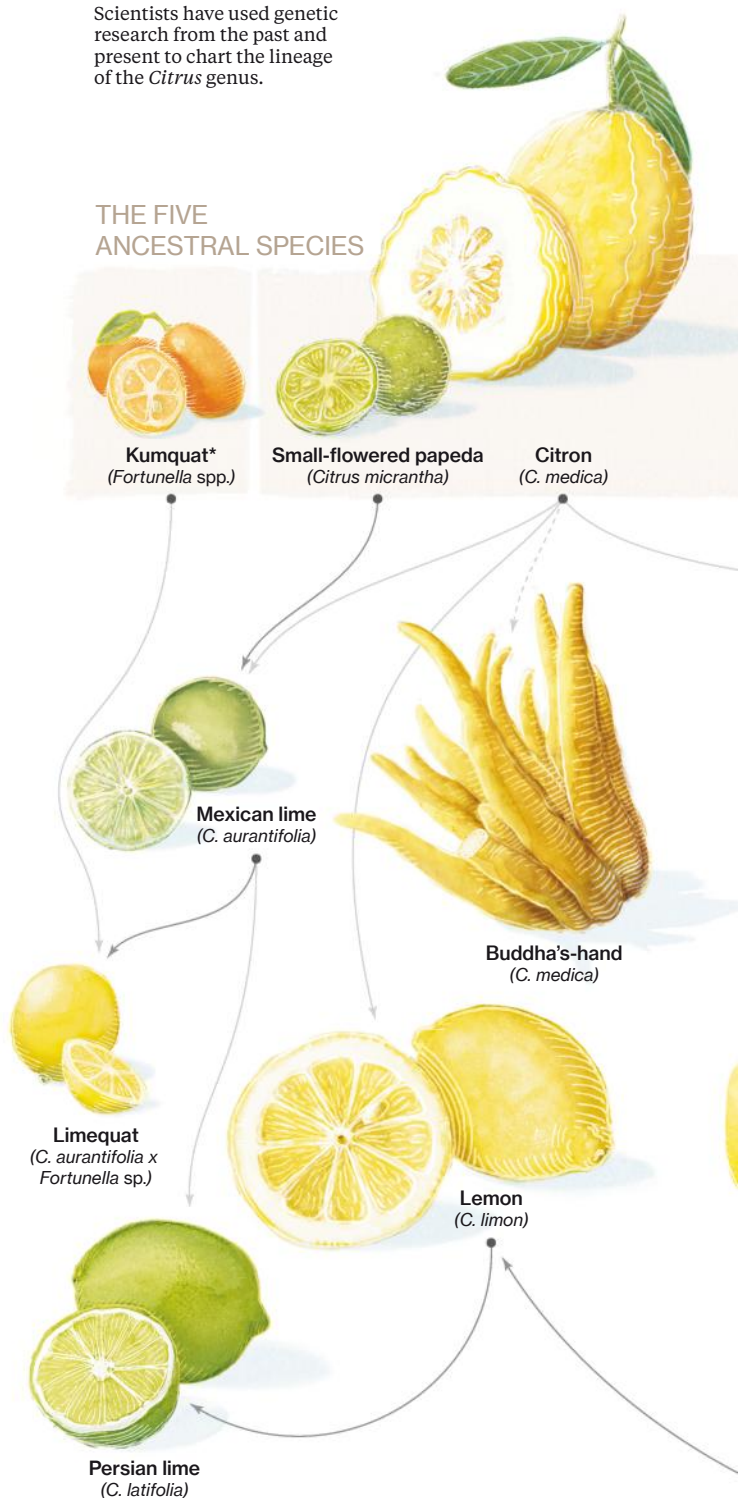
Citrus, in many ways, stands alone. So many cultivated species have come from just three primary ancestors: citrons, pomelos, and mandarins, all native to South and East Asia. These three, plus a few other minor parents, have the rare genetic combination of being sexually compatible and highly prone to mutation. Such traits allow their genes to mix—both on their own and at the hands of humans. The product of so much natural crossing in the wild and selective breeding at research farms and in fields is every orange, lemon, lime, and grapefruit you've ever eaten.

No other fruit genus can boast such an intricate pedigree, and new research is bringing clarity to its origin. Grapefruits are a human discovery, less than 300 years old. But citrus itself is ancient. Fossilized leaves discovered in China's Yunnan Province in 2009 and 2011 suggest citrus has existed since the late Miocene epoch, as many as seven million years ago. Humans, however, have brought a great winnowing: Out of thousands of wild types, only a few dozen have become commercial behemoths like the navel orange, Eureka lemon, and Mexican lime. They're the citrus one percent.

"There's something fascinating, freaky, even sexy about citrus," says pomologist David Karp, whose research informs the illustration at right. A bacterial disease called huanglongbing (or citrus greening) is threatening commercial production on every arable continent, including in Florida, the state made famous by oranges. Yet the future is likely to bring more types of citrus, not fewer. "Citrus is competitive," says citrus breeder and geneticist Fred Gmitter, with global researchers racing to develop, say, mandarin oranges that are sweeter, seedless, and easier to peel. "In the near future you'll see a lot of outside-the-box new stuff." And an ever expanding family tree.

Fruits' family tree

Scientists have used genetic research from the past and present to chart the lineage of the *Citrus* genus.





PARENTAGE KEY

- Seed parent (female)
- Pollen parent (male)
- - - Mutation

Pomelo
(*C. maxima*)

Mandarin**
(*C. reticulata*)

Likely extinct
parent hybrids

Meyer lemon
(*C. x meyeri*)

Sweet orange
(*C. sinensis*)

Sour orange
(*C. aurantium*)

Grapefruit
(*C. paradisi*)

Tangelo
(*C. x tangelo*)

Blood orange
(*C. sinensis*)

*RESEARCHERS CONTINUE TO DEBATE WHETHER KUMQUATS ARE INDEED IN THE *CITRUS* GENUS.
**MOST "PURE" MANDARINS HAVE A SMALL PROPORTION OF POMELO GENES.



BUGS ARE IN OUR FOOD— AND THAT'S OK

By Daniel Stone

Of all the substances on Earth, very few can make the rich, soulful red you see on this page. It's the red of lipstick and cheek blush, berry-flavored yogurt, juices, imitation crab, and, until the ingredient was dropped in 2012, Starbucks' strawberry smoothies. The compound that makes this red helps explain why the chain's customers recoiled: It's pulverized insects.

For the National Geographic web series *Ingredients*, chemist George Zaidan studies what's inside the food we eat and the items we commonly use. The powder above, extract of cochineal, tends to come up a lot. The cochineal bugs—a species of scale insect—are a centuries-old colorant. In the 19th century, chemists figured out how to make a synthetic alternative. But 21st-century

consumers insist on ingredients that are “natural”—which means the bugs are back in season.

Is there any risk to eating crunched-up-insect extract? The Food and Drug Administration says no—as do people in Ghana, Papua New Guinea, and Bali, who make termites, beetle larvae, or dragonflies an occasional part of their diet. The U.S. food-regulating agency permits a generous threshold of insects in foods before they're considered contaminated: up to 60 aphids in 100 grams of frozen broccoli or 550 insect fragments per average box of pasta. In inspectors' view, bugs happen.

Cochineal extract has few restrictions, provided it's labeled clearly and not with a euphemism like “natural colors.” And to some food manufacturers, an organic, reliable, and beautiful source of color is a no-brainer. The obstacle tends to be psychological—but in Zaidan's opinion, consumers should get over it. “With few exceptions, your body can handle pretty much anything you eat,” he says. “So if you don't think about it, you'll be fine.”

Watch *Ingredients* to learn more about cochineal extract and the odd elements in things like gum, peanut butter, and toothpaste.

ONLINE
natgeo.com/ingredients

TWITTER
[@GeorgeZaidan](https://twitter.com/GeorgeZaidan)

LEAVE A LEGACY OF LOVE

By including the National Geographic Society in your will, trust, or beneficiary designation, you can pass on your love of exploration, science, and conservation to future generations. These gifts cost you nothing now and allow you to change your beneficiaries at any time.



COPYRIGHT © 2017 NATIONAL GEOGRAPHIC SOCIETY

SUSAN McCONNELL, NATIONAL GEOGRAPHIC YOUR SHOT



CREATE A LEGACY OF YOUR OWN

☐ Yes! Please send me information on how to include the National Geographic Society in my will.

☐ The National Geographic Society has already been included in in my will.

☐ I would like to speak to someone about making a gift. Please call me.

CONTACT US: Email: plannedgiftinfo@ngs.org
Toll free: (800) 226-4438

OR VISIT: www.nationalgeographic.org/give

Name _____

Address _____

Phone _____

Email _____

Mail to National Geographic Society
Office of Planned Giving
1145 17th Street, N.W.
Washington, D.C. 20036-4688

Stardom & Sci-Fi

She's won an Oscar for acting, a Tony for producing, a Grammy for a comedy album, a couple of Emmys—and played an alien on a *Star Trek* television series. What more could **Whoopi Goldberg** desire? To help her friend Neil tackle some big questions—about asteroids hurtling toward Earth, realistic superheroes, and zombie saliva.



Neil deGrasse Tyson is the host of *StarTalk*, airing Mondays through February 6 at 11/10c on National Geographic. His new book *StarTalk: Everything You Ever Need to Know About Space Travel, Sci-Fi, the Human Race, the Universe, and Beyond*, is available wherever books are sold and at shopnpg.com/startalk.

WILLIAM CALLAN, CONTOUR
BY GETTY IMAGES

Neil deGrasse Tyson: You're one of 12 people, is it, who have won the Tony, the Oscar, the Emmy, and the Grammy? That's crazy, girl!

Whoopi Goldberg: I think there are more of us than 12, but thanks. And you—you know, you're like the smartest man on the Earth. People are like, "I love him! I hated science before he started talking." When you find somebody who can explain to you those things which you think you're too dumb to understand, it's a magnificent thing.

NT: So do you have any question for me? Is there any science question that has plagued you?

WG: Well, I do want to know: Every couple of years we hear that some asteroid is heading our way. What's happening that suddenly we're seeing it more and more?

NT: We have a greater capacity than ever before to monitor asteroids that have close approaches. For me the danger zone is, are you coming closer to Earth than the orbit of the moon? I count that as an invasion of our space. Get the hell out of my living room, right? Or my backyard.

WG: Right.

NT: A few times a decade we get an asteroid the size of a small building or a large car coming in between us and the moon. Maybe that's enough for you to say, "Hey, let's build an asteroid defense system." Because you know the dinosaurs would have done that if they

could. If they had a big enough brain and opposable thumbs.

WG: What does that system look like?

NT: There's the macho version of it, where you get your nukes and you blow it out of the sky.

WG: But doesn't that mean that other stuff is raining down?

NT: That's what I'm saying. We're really good at blowing stuff up and less good at knowing where the pieces will fall. So the kinder, gentler way is to nudge it off its current course. It will still be there on another orbit, but you get to have it not hit us this time around.

WG: So the idea of a laser destroying the asteroid is out?

NT: One idea is, as the asteroid is moving through space, you beam lasers on one side of it. You vaporize that side of the asteroid, it outgasses, and that creates a recoil to push it in the other direction. Both of these are trying to change its orbital path.

WG: There are satellites all around, right? Why can't a satellite be used to shoot it?

NT: By the time it's close enough for satellites that are in low Earth orbit to hit it, it's too late. When I talk about changing the path, I'm talking about seven orbits in advance. Say the asteroid's on a 10-year orbit and on the seventh orbit, 70 years from now, it's going to hit Earth. I'm going to deflect it today so that in



70 years it misses us. That's how you've got to do this. If it's on the last path in to the Earth, forget it. You'd be hosod.

WG: I have to tell you, with the announcement recently of finding—what did they say—1,200 new exoplanets out there, that didn't make me feel better. Because I don't know where those planets are. What are they doing? Who's on them?

NT: Your interest in science fiction—did that influence you to take the gig on *Star Trek: The Next Generation*? I remember growing up, we would see science fiction stories and I'd say, "How come there are no black aliens?"

WG: Because they were green, Neil. They were green.

NT: Does that scare you, that there were no black people in anybody's vision of the future?

WG: Well, I realized as a kid that I didn't understand that, because I loved sci-fi. So when LeVar Burton comes to my house and tells me, "I'm getting ready to do *Star Trek*," I was like, "Dude, I want in." He was like, "I'll tell them." I saw him about eight months later and said, "Dude, did you tell them?" He said, "I told them, but they didn't believe it." I said, "Call them right now. Set up a lunch" [with *Star Trek* creator Gene Roddenberry].

Gene says, "So, you want to do *Star Trek*?" I said, "Yeah. You don't understand: This was a huge part of my life because as a kid who loved science fiction, not until Lieutenant Uhura did I realize that I was in the future." He said, "What do you mean?" I said, "Gene, if you look at science fiction movies that predate *Star Trek*, there are no people of color anywhere. Anywhere. Unless you go to Japan, where you see the Godzilla movies, but we're nowhere else." He was like, "I don't think I knew that." I said, "Well, you know now."

So he created my character, Guinan, and he built this bar for me on the starship U.S.S. *Enterprise*. I may be the last creature he created. [Roddenberry died in 1991.]

NT: Do you still have a little bit of science fiction in you? There's some movies



you might want to be in?

WG: I would love to do any science fiction that's happening, and also all of the superhero movies. Because you know, I'm a woman of a certain age who's grown up with Superman and Batman and Supergirl and all of the DC and Marvel Comics universes. And there's nothing out there for women of a certain age. I want to see somebody who saves the Earth who looks a little bit like me. Whose behind is a little bit bigger. Whose chest is on the floor. But when the superpowers kick in, whew! She could slap a whole nation of people on the way to taking care of business.

NT: Here's a question I have. How come if humans bite zombies, the zombies don't become human? That's what I want to know.

WG: Because there's some enzyme that messes you up as a zombie.

NT: I know, but why can't I turn a zombie back into a human if I bite him?

WG: Because you don't have an enzyme in your teeth or in your saliva that will work that way. It's a one-way thing.

NT: Oh, OK. You've thought about that.

WG: Clearly, I have too much time on my hands. And I've watched too many zombie movies.

NT: Thank you for solving all that.

WG: I try. You do the universe, I do the zombie world.

In 1988 Whoopi Goldberg (back row, far left) joined the cast of the television show *Star Trek: The Next Generation*, which ran from 1987 to 1994. She played Guinan, an alien who ran a bar on the starship U.S.S. *Enterprise*.

WHAT A FIND.

National Geographic Unique Lodges of the World is a collection of handpicked lodges that invite guests to experience the world's most treasured places while helping to protect them for generations to come. From their remarkable architecture to their fine cuisine, these properties offer guests intimate and inspiring encounters with parts of the world not many get to know—and the chance to slow down and truly discover them.

Find your next destination at natgeolodges.com, or call **1-888-701-5486** to speak to a National Geographic travel specialist.



UNIQUE LODGES
OF THE WORLD™

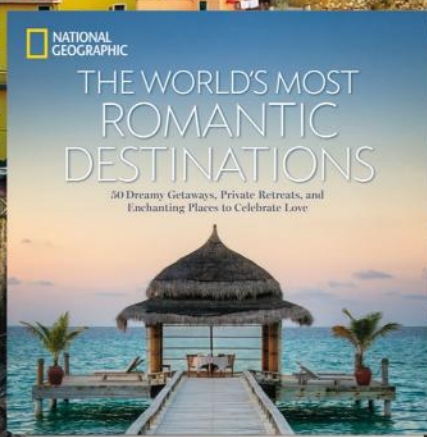
© 2017 National Geographic Partners, LLC.

NATIONAL GEOGRAPHIC UNIQUE LODGES OF THE WORLD and the Yellow Border Design are registered trademarks of the National Geographic Society, used under license.

Photo: Tierra Atacama Hotel & Spa, Atacama Desert, Chile

FALL IN LOVE

WITH THESE DREAM
GETAWAYS



Discover 50 of the world's most romantic places in this elegant book of vacation inspiration. Captivating photographs and practical tips on traveling to these alluring locales offer the perfect passionate escape to those who have just found love or are celebrating a lifetime of it.

AVAILABLE WHEREVER BOOKS ARE SOLD
AND AT NATIONALGEOGRAPHIC.COM/BOOKS

NATGEOBOOKS @NATGEOBOOKS



© 2017 National Geographic Partners, LLC

If you purchased certain Blue Diamond's Products you may be entitled to a cash benefit as part of a proposed class action settlement

A proposed class action settlement has been reached concerning claims over whether Blue Diamond Growers ("Blue Diamond") improperly advertised, marketed, and labeled certain products. Blue Diamond denies it did anything wrong. The court has not decided who is right.

You may be an eligible class member if, between May 28, 2009 and November 18, 2016, you purchased in the United States, Blue Diamond Almond Breeze and/or Nut-Thins Products which were manufactured, advertised, or sold by Blue Diamond and which (1) bore the labeling statement "All Natural" or "Natural" on any portion of the packaging other than the ingredients list; (2) contained the ingredient statement Evaporated Cane Juice; (3) contained an endorsement from the American Heart Association; and/or (4) did not specifically disclose the amount or percentage of almonds in the product.

What are the benefits and how can I submit a claim?

In addition to making certain changes to its labeling and marketing statements, Blue Diamond will provide cash benefits not to exceed \$7,500,000.00 for the Almond Breeze Products and \$1,495,000.00 for the Nut-Thins Products to pay for (1) Administrative Costs; (2) any award of Attorneys' Fees and Costs to Class Counsel; (3) any Incentive Awards to the Class Representatives; and (4) Valid Claims.

Class Members who purchased Almond Breeze or Nut-Thins Products and who submit a Valid Claim *without a proof of purchase* may receive \$1.00 per unit of Almond Breeze Products purchased up to a maximum of 5 units (\$5.00) per Household, and \$1.00 per unit of Nut-Thins Products purchased up to a maximum of 5 units (\$5.00) per Household. Class Members who purchased Almond Breeze or Nut-Thins Products and who submit a Valid Claim *along with proof of purchase* may receive \$1.00 per unit of Almond Breeze Products purchased up to a maximum of 10 units (\$10.00) per Household, and \$1.00 per unit of Nut-Thins Products purchased up to a maximum of 10 units (\$10.00) per Household. The actual benefit will depend upon the total number of Valid Claims received from Class Members. One claim may be made per Household.

To receive payment, a Claim Form **MUST** be completed and either be submitted online (www.BreezeAndThinsSettlement.com) or postmarked by April 13, 2017.

What are my Options?

If you're a Class Member, you have the following options: (1) **Submit a Claim:** Submit a claim to be eligible for a payment. (2) **Do nothing:** You will not receive payment and you will be bound by the Court's Orders and Judgment and give up your right to sue Blue Diamond and certain other persons and entities about the legal claims resolved by the settlement. (3) **Exclude yourself:** Keep the right to sue Blue Diamond about the legal claims involved in this matter, but **you will not receive payment from this settlement.** The exclusion deadline is March 2, 2017. (4) **Object/Request To Appear:** Write to the Court and say why you don't like the settlement and/or request permission to speak at the fairness hearing by March 2, 2017.

The Court will hold a Fairness Hearing at 9:00 a.m. on March 29, 2017, in the Washington County Circuit Court, Civil Division, 280 North College Avenue, Fayetteville, Arkansas 72701. The Court will consider whether the proposed settlement is fair, reasonable, and adequate and whether to approve attorneys' fees and costs to Class Counsel and service awards to Class Representatives, and consider objections, if any. The motion for attorneys' fees and costs will be posted on the website.

Do I Have a Lawyer in the case?

The Court has appointed Class Counsel (for both Almond Breeze and Nut-Thins Products) who will be compensated from the respective Almond Breeze settlement fund and Nut-Thins settlement fund made available by the settlement. If you want to be represented by your own lawyer, you may hire one at your own expense.

This notice is only a summary. For the long-form notice or further information, visit www.BreezeAndThinsSettlement.com, or call 1-844-528-0184, or write to the Claims Administrator at Blue Diamond Settlement, c/o Heffler Claims Group, P.O. Box 58427, Philadelphia, PA 19102-8427.

1-844-528-0184

www.BreezeAndThinsSettlement.com

MEERKAT *SURICATA SURICATTA*

HABITAT/RANGE

Deserts, grasslands of southern Africa

CONSERVATION STATUS

Least concern

OTHER FACTS

In the wild, meerkats eat mainly insects and small rodents – and scorpions, whose stingers they learn to remove.



THROWING HER WEIGHT AROUND

By Patricia Edmonds

Imagine a commune where up to 50 individuals cohabit but only two get to have sex. That's essentially the cooperative breeding system of meerkat groups, in which one dominant male and female monopolize the mating and pup-bearing.

What helps that female keep her coveted position? For one thing, weight gain.

Since founding the Kalahari Meerkat Project in 1993, University of Cambridge professor Tim Clutton-Brock has studied some 100 meerkat groups. By means of age, weight, and aggressiveness, a male and a female become each group's dominants and breeders. Other members act as sentries, burrowers, and babysitters.

As subordinates mature, males often leave the group. Females can stay, and the oldest and heaviest usually succeeds the dominant at her death. Researchers wondered: If lighter females in that waiting line gained weight, would heavier females also increase their growth to stay ahead?

To test that idea, for weeks researchers fed a boiled egg a day to one set of meerkat females but not their littermates. They trained both sets to climb onto scales, logged their weights—and found that those not fed still gained weight as the others did, by upping their foraging. To researcher Elise Huchard, it shows that meerkats “can track changes in the growth and size of potential competitors, and react by adjusting their own growth.”

Warding off challenges by gaining weight is a relatively benign approach. If subordinate females attempt to breed, dominant ones may harass them until they abort, or kill pups they bear. “If you get to the breeding position, you’ve hit the reproductive jackpot,” Clutton-Brock says. “That’s worth fighting for.”





A 9,000-Year Love Affair

Alcohol isn't just a mind-altering drink: It has been a prime mover of human culture from the beginning, fueling the development of arts, language, and religion.



A Chinese newlywed toasts her guests with a traditional cup of rice wine. The drink has been consumed in China for at least 9,000 years; a chemical residue found in a jar of that age is the oldest proof of a deliberately fermented beverage. But the influence of alcohol probably extends even deeper into prehistory.

By Andrew Curry
Photographs by Brian Finke

If you're a beermaker in Germany, Martin Zarnkow is a guy you want to know. Students come to his department at the Technical University of Munich because it's one of the few places in this nation of beer drinkers to get a degree in brewing science. Some of Germany's biggest breweries come to Zarnkow to troubleshoot funky tastes, develop new beers, or just purchase one of his hundreds of strains of yeast. His lab is secured with coded door locks and filled with sophisticated chemical equipment and gene sequencers. But today he's using none of that.

Instead I find him down the hall, hunched over an oven in the employee kitchen, poking what looks like a pan of mushy granola cookies with a black plastic spatula. The cookies are made from brewer's malt—sprouted, toasted barley grains—mixed with wheat flour and a few spoonfuls of sourdough starter. Pouring a coffee, Zarnkow tells me that his plan today is to re-create beer from a 4,000-year-old Sumerian recipe.

Zarnkow, who started his career as a brewer's apprentice, is also an eminent beer historian. He's a big man with a full salt-and-pepper beard, ruddy cheeks, a booming voice, and a belly that strains the buttons on his short-sleeved plaid shirt. Put him in a brown habit and he'd be well cast as a medieval monk, the one in charge of stocking the abbey with barrels of ale. The former abbey next door, for example: Zarnkow's building shares a hilltop, overlooking the Munich airport, with the Weihenstephan brewery, which was founded by Benedictine monks in A.D. 1040 and is the oldest continually functioning brewery in the world.

You don't have to be a regular at an Oktoberfest to know that Germany has a long history with beer. But Germany also has a long history with

sausages. France started making wine in earnest only after it was conquered by the Romans (as did most of Europe) and has never looked back—but the French are also famously fond of cheese. For a long time that's about how most historians and archaeologists have regarded beer and wine: as mere consumables, significant ones to be sure, but not too different from sausages or cheese, except that overconsumption of alcohol is a far more destructive vice. Alcoholic beverages were a by-product of civilization, not central to it. Even the website of the German Brewers' Federation takes the line that beer was likely an offshoot of breadmaking by the first farmers. Only once the craft blossomed at medieval abbeys like Weihenstephan did it become worth talking about.

Zarnkow is one of a group of researchers who over the past few decades have challenged that story. He and others have shown that alcohol is one of the most universally produced and

In parts of South America the corn beer known as chicha has been a staple for thousands of years. Brewing it has traditionally been women's work. A page from a 16th-century Spanish chronicle made in Peru shows a noblewoman serving chicha to an Inca emperor, who raises it to toast the sun god, Inti.







Outside a *chichería* in Lamay, Peru, in the Sacred Valley of the Inca Empire, Lucio Chávez Díaz drinks a glass of chicha *frutillada*, a corn beer flavored with strawberries. The pure beers, wines, and spirits of today are a historical exception; alcoholic beverages have long been doctored with everything from pine needles to tree resins to honey. Ancient Greek warriors even grated goat cheese onto their beer. When the Inca drank chicha out of wooden cups called *keros* – like this 17th-century one – they often stirred not strawberries but psychoactive herbs into the beer.

PHOTOGRAPHED AT MUSEO INKA DE LA UNIVERSIDAD NACIONAL
SAN ANTONIO ABAD DEL CUSCO, PERU (KERO)







Alcohol lowers inhibitions, and that can make people feel closer to their friends and to the spiritual world. The Inca consumed chicha in feasts that lasted days; they offered it to the gods on mighty altars. At a chicheria in Cusco today, men drink as they play cards, while at a shrine in one corner of the bar (left), a glass is offered to a Peruvian icon known as the Black Christ. The centuries have added layers to Peruvian culture, and Christianity has replaced worship of the sun and moon as the dominant religion – but the ancestral tipple endures.



enjoyed substances in history—and in prehistory too, because people were imbibing alcohol long before they invented writing. Zarnkow's Sumerian beer is very far from the oldest. Chemical analysis recently showed that the Chinese were making a kind of wine from rice, honey, and fruit 9,000 years ago. In the Caucasus Mountains of modern-day Georgia and the Zagros Mountains of Iran, grapes were one of the earliest fruits to be domesticated, and wine was made as early as 7,400 years ago.

All over the world, in fact, evidence for alcohol production from all kinds of crops is showing up, dating to near the dawn of civilization.

soft in the middle—Zarnkow carries them from the kitchen to an upstairs lecture hall. There, in front of his class, he slides them into a huge glass pitcher, then scoops in more crushed barley malt and some milled emmer, an ancient grain, as the Sumerians would have done. The final ingredient: three quarts of tap water from a sink in the hallway. Zarnkow stirs the resulting slop with his kitchen spatula until it's a uniform, yellowish beige, like bread dough.

It looks decidedly unappetizing. But by tomorrow, Zarnkow promises, this will be beer—a primitive, wild beer, one that people 5,000 or more years ago might have been intimately

Look closely at great transitions in human history, from the origin of farming to the origin of writing, and you'll find a possible link to alcohol.

University of Pennsylvania biomolecular archaeologist Patrick McGovern believes that's not an accident. From the rituals of the Stone Age on, he argues, the mind-altering properties of booze have fired our creativity and fostered the development of language, the arts, and religion. Look closely at great transitions in human history, from the origin of farming to the origin of writing, and you'll find a possible link to alcohol. "There's good evidence from all over the world that alcoholic beverages are important to human culture," McGovern says. "Thirty years ago that fact wasn't as recognized as it is now." Drinking is such an integral part of our humanity, according to McGovern, that he only half jokingly suggests our species be called *Homo imbibens*.

Today Zarnkow is trying to connect his students with those roots. The barley cookies are a vehicle for the sourdough, which contains the yeast that will make the magic happen. When the cookies are ready—dark brown on top, still a little

familiar with. "Mix three different ingredients with water, and that's it," he says. "Craft brewers today aren't discovering anything new. Billions of people have brewed, over thousands of years."

All through my visit I've been distracted by a rich, malt aroma wafting through the open windows from the brewery next door. It's a primal, pleasant smell, and it taps into a part of my brain that makes me want to stop, sit down, inhale deeply, and take a seat in the nearest beer garden.

We Come Down From the Trees for Booze

The story of humanity's love affair with alcohol goes back to a time before farming—to a time before humans, in fact. Our taste for tippie may be a hardwired evolutionary trait that distinguishes us from most other animals.

The active ingredient common to all alcoholic beverages is made by yeasts: microscopic, single-celled organisms that eat sugar and excrete carbon dioxide and ethanol, the only

potable alcohol. That's a form of fermentation. Most modern makers of beer, wine, or sake use cultivated varieties of a single yeast genus called *Saccharomyces* (the most common is *S. cerevisiae*, from the Latin word for "beer," *cerevisia*). But yeasts are diverse and ubiquitous, and they've likely been fermenting ripe wild fruit for about 120 million years, ever since the first fruits appeared on Earth.

From our modern point of view, ethanol has one very compelling property: It makes us feel good. Ethanol helps release serotonin, dopamine, and endorphins in the brain, chemicals that make us happy and less anxious.

To our fruit-eating primate ancestors swinging through the trees, however, the ethanol in rotting fruit would have had three other appealing characteristics. First, it has a strong, distinctive smell that makes the fruit easy to locate. Second, it's easier to digest, allowing animals to get more of a commodity that was precious back then: calories. Third, its antiseptic qualities repel microbes that might sicken a primate. Millions of years ago one of them developed a taste for fruit that had fallen from the tree. "Our ape ancestors started eating fermented fruits on the forest floor, and that made all the difference," says Nathaniel Dominy, a biological anthropologist at Dartmouth College. "We're preadapted for consuming alcohol."

Robert Dudley, the University of California, Berkeley physiologist who first suggested the idea, calls it the "drunken monkey" hypothesis. The primates that ventured down out of the trees got access to a brand-new food source. "If you can smell the alcohol and get to the fruit faster, you have an advantage," Dudley says. "You defeat the competition and get more calories." The ones that stuffed themselves were the most likely to succeed at reproduction—and to experience (while eating) a gentle rush of pleasure in the brain. That buzz reinforced the appeal of the new lifestyle.

A truly drunken monkey, Dudley points out, would be an easy target for predators. In spite of widely reported anecdotes, there's very little scientific evidence of animals in the wild ever getting enough alcohol from fermented fruit to exhibit drunken behavior. A satisfied glow is

more likely. But that response to alcohol seems to be specific to humans and perhaps apes.

The reason may be a critical gene mutation that occurred in the last common ancestor of African apes and us; geneticists recently dated the mutation to at least 10 million years ago. This change in the *ADH4* gene created an enzyme that made it possible to digest ethanol up to 40 times faster. According to Steven Benner, a co-author of the study and a biologist at the Foundation for Applied Molecular Evolution in Alachua, Florida, the new improved enzyme enabled our ancestors to enjoy more of the overripe bounty on the forest floor, without suffering ill effects.

"You could say we came out of the trees to get a beer," Benner says. But the point wasn't to get drunk. That would come much later, once we figured out how to make the stuff in quantity.

We Settle Down and Farm for Booze

Flash forward millions of years to a parched plateau in southeastern Turkey, not far from the Syrian border. Archaeologists there are exploring another momentous transition in human prehistory, and a tantalizing possibility: Did alcohol lubricate the Neolithic revolution? Did beer help persuade Stone Age hunter-gatherers to give up their nomadic ways, settle down, and begin to farm?

The ancient site, Göbekli Tepe, consists of circular and rectangular stone enclosures and mysterious T-shaped pillars that, at 11,600 years old, may be the world's oldest known temples. Since the site was discovered two decades ago, it has upended the traditional idea that religion was a luxury made possible by settlement and farming. Instead the archaeologists excavating Göbekli Tepe think it was the other way around: Hunter-gatherers congregated here for religious ceremonies and were driven to settle down in order to worship more regularly.

Nestled inside the walls of some smaller enclosures are six barrel- or trough-shaped stone vessels. The largest could hold 40 gallons of liquid. The archaeologists suggest that they were used to brew a basic beer from wild grasses.

Analyzing residues from several of those tubs,





The oldest firm evidence of an alcoholic beverage comes from Jiahu, China, where by 7000 B.C. farmers were fermenting a mix of rice, grapes, hawthorn berries, and honey in clay jars. Early Chinese emperors had bronze drinking vessels like this one, from 1100 B.C. (below), for sipping rice wine. It's still a popular drink in China. At the Zhejiang Pagoda Brand Shaoxing Winery (left), workers steam and ferment freshly harvested rice in the winter, when water from the nearby river is at its purest. Since the Song dynasty, around A.D. 1200, Chinese winemakers have commonly used specialized mold to break down the starch and make rice fermentable; before that they may have chewed the grains.

YINXU MUSEUM, ANYANG, CHINA (DRINKING VESSEL)







The wine grape may have originated at the foot of the Caucasus Mountains in Georgia, which has more than 500 indigenous varieties. For millennia Georgians have fermented wine in beeswax-lined clay jars called *qvevri*, made by craftsmen like Zaliko Bodjadze (below). Winemakers bury the jars up to the neck and use them for generations. Some traditional Georgian whites – like the one being poured by Sulkhan Gulashvili (left), from a cup inscribed with the names of his forebears – are fermented as red wines are, with the grape skins, seeds, and even stems left in the juice. That gives them a bold flavor and a distinctive orange hue.



Zarnkow found evidence of oxalate, a crusty, whitish chemical left behind when water and grain mix. One vessel contained the shoulder bone of a wild ass, just the right size and shape to stir a foaming, fermenting broth of grain and water. The whole hilltop at Göbekli Tepe is filled with hundreds of thousands of animal bones, mostly gazelle and barbecue-ready cuts of aurochs, a prehistoric cousin to the cow.

Add it all together, and you have the makings of an impressive feast, enough to attract hundreds of hunter-gatherers to that prominent hill. One purpose of the alcohol may have been the same one that leads South American shamans

then over time to selectively breed them into the high-yielding barley, wheat, and other grains we know today. Some of the earliest evidence of domesticated grain—an ur-wheat called einkorn—comes from a site a few dozen miles away from Göbekli Tepe. The coincidence is suggestive.

But proof is elusive. Zarnkow is quick to admit that oxalate proves that grain was present in the stone tubs at Göbekli Tepe, but not that the grain was fermented. It's possible, he says, that the tubs were used to make gruel to feed the workers, not beer to get them buzzed.

Patrick McGovern acknowledges the uncertainty but still says the beer-before-bread theory

'Our ape ancestors started eating fermented fruits on the forest floor, and that made all the difference. We're preadapted for consuming alcohol.'

Nathaniel Dominy, biological anthropologist, Dartmouth College

today to take hallucinogens: to induce an altered state that puts them in touch with the spirit world. But researchers here think something else was going on too. The organizers of the feast, they say, were using the barbecue and the booze brewed from wild grains as a reward. Once the partygoers arrived, they pitched in to erect the site's massive pillars, which weigh up to 16 tons.

The outlines of the deal have changed little in the thousands of years since. "If you need someone to help you move, you buy them pizza and a couple of beers," says German Archaeological Institute researcher Jens Notroff.

The idea that's gaining support at Göbekli Tepe was first proposed more than half a century ago: Beer, rather than bread, may have been the inspiration for our hunter-gatherer ancestors to domesticate grains. Eventually, simply harvesting wild grasses to brew into beer wouldn't have been enough. Demand for reliable supplies pushed humans first to plant the wild grasses and

is solid. In 2004 he published evidence of a cocktail made of rice, hawthorn berries, honey, and wild grapes at Jiahu, a site in China just a few thousand years younger than Göbekli Tepe. The people there had only recently made the transition to farming. Yet the combination of ingredients, plus the presence of tartaric acid, a key chemical signature of wine, convinces McGovern that Jiahu farmers were already concocting sophisticated mixed beverages: It's the earliest evidence for beer, wine, and mead, all in one.

"The domestication of plants is driven forward by the desire to have greater quantities of alcoholic beverages," McGovern says. "It's not the only factor driving forward civilization, but it plays a central role."

We Drink It for Our Health

Alcoholic beverages, like agriculture, were invented independently many different times, likely on every continent save Antarctica. Over

the millennia nearly every plant with some sugar or starch has been pressed into service for fermentation: agave and apples, birch tree sap and bananas, cocoa and cassavas, corn and cacti, molle berries, rice, sweet potatoes, peach palms, pineapples, pumpkins, persimmons, and wild grapes. As if to prove that the desire for alcohol knows no bounds, the nomads of Central Asia make up for the lack of fruit and grain on their steppes by fermenting horse milk. The result, koumiss, is a tangy drink with the alcohol content of a weak beer.

Alcohol may afford psychic pleasures and spiritual insight, but that's not enough to explain its universality in the ancient world. People drank the stuff for the same reason primates ate fermented fruit: because it was good for them. Yeasts produce ethanol as a form of chemical warfare—it's toxic to other microbes that compete with them for sugar inside a fruit. That antimicrobial effect benefits the drinker. It explains why beer, wine, and other fermented beverages were, at least until the rise of modern sanitation, often healthier to drink than water.

What's more, in fermenting sugar, yeasts make more than ethanol. They produce all kinds of nutrients, including such B vitamins as folic acid, niacin, thiamine, and riboflavin. Those nutrients would have been more present in ancient brews than in our modern filtered and pasteurized varieties. In the ancient Near East at least, beer was a sort of enriched liquid bread, providing calories, hydration, and essential vitamins.

At Tall Bazi, a site in northern Syria, a German excavation revealed a clutch of about 70 houses overlooking the Euphrates River that were abandoned during a sudden fire almost 3,400 years ago. The long-ago catastrophe was a blessing for archaeologists: The fire forced Tall Bazi's residents to flee in the middle of daily tasks such as cooking. It thus captured for all time a moment in the town's everyday life.

In each house, usually close to the front door, the excavators found a huge, 50-gallon clay jar sunk into the floor. Chemical analysis—by Zarnikow again—revealed traces of barley and thick crusts of oxalate in the jars. In effect, each of Tall

Bazi's houses had its own nanobrewery.

By 3150 B.C., long before the fire that wiped out Tall Bazi, the ancient Egyptians had progressed beyond home brew: They were maintaining industrial-scale breweries of the sort that were eventually used to supply workers building the great Pyramids at Giza. Beer was such a necessity in Egypt that royals were buried with miniature breweries to slake their thirst in the afterlife. In ancient Babylon beer was so important that sources from 500 B.C. record dozens of types, including red beer, pale beer, and dark beer.

Indirectly, we may have the nutritional benefits of beer to thank for the invention of writing, and some of the world's earliest cities—for the dawn of history, in other words. Adelheid Otto, an archaeologist at Ludwig-Maximilians University in Munich who co-directs excavations at Tall Bazi, thinks the nutrients that fermenting added to early grain made Mesopotamian civilization viable, providing basic vitamins missing from what was otherwise a depressingly bad diet. "They had bread and barley porridge, plus maybe some meat at feasts. Nutrition was very bad," she says. "But as soon as you have beer, you have everything you need to develop really well. I'm convinced this is why the first high culture arose in the Near East."

We Always Go Too Far

And then, of course, there is the other side of the story. There are the lengths to which people throughout history have gone to go on a bender.

Before the Celtic ancestors of the French learned to produce wine themselves, they imported it from the Greeks, Etruscans, and Romans. In a wheat field at the end of a winding mountain road in central France, at an archaeological site called Corent, I get a taste of this dependency. My guide is Matthieu Poux, a Franco-Swiss archaeologist with a crew cut, blue aviator shades that match his shirt, and a firm handshake. All around us the extinct volcanoes of France's Massif Central stab the sky.

At Corent, Poux leads some 50 French archaeologists and students who are uncovering the foundations of a major Celtic ceremonial center

Wine was the beverage of choice in ancient Rome, and from there it spread throughout the empire, including France. At Mas des Tourelles, an estate near the southern French town of Arles, vintner Hervé Durand worked with archaeologists to re-create Roman wines from first-century A.D. recipes – and to reenact the ancient process of winemaking. Grapes are picked by locals dressed as Roman slaves (below), snacked on by a Roman soldier (right), and pressed with a massive oak-tree trunk. The juice is then fermented in open clay jars. The Romans flavored it with surprising ingredients: One of Durand's wines contains fenugreek, iris, and seawater.







Alcohol Through the Ages

Some 10 million years ago, a shared ancestor of humans and African apes evolved an enzyme that could rapidly digest the alcohol in fermented fruit. That set the biological stage for the past 10,000 years—in which people the world over have made alcoholic beverages by fermenting sugars in all sorts of fruits and even by finding ways to ferment starchy grains and roots.

Drinking locally, trading globally

In early civilizations, fermented beverages were made first from whatever wild plants were available locally and later from domesticated plants. As trade between civilizations grew, technology and techniques for brewing and wine-making spread throughout the ancient world.

 Zones of early fermented beverage experimentation

 Exchange of information about fermented beverages


Searching for proof

Firm evidence for early consumption of alcohol comes from analysis of ancient chemical residues; the earliest so far is from China. Other dates are estimated from indirect evidence, such as when a plant used to make alcohol first appears in the archaeological record.

Corn and the Americas


Corn was domesticated around 7000 B.C. Chicha, made from fermented corn, and the drunken feasts it abetted were first chronicled by Spanish explorers in the 16th century.

NORTH AMERICA

 Cacao wine
ca 1400 B.C.


Mesoamericans drank this fruit wine by blowing air into a pot, then drinking froth and liquid from its top.

4000 B.C.


 Cassava beer
ca 4000 B.C.

Ancient brewers made a potent drink by chewing the starchy root first; a saliva enzyme converts starch into fermentable sugar.

SOUTH AMERICA

 Pepper berry wine
ca A.D. 600

The bright red fruit of the Peruvian pepper tree was fermented into a strong wine.

 Potato chicha
ca 13,000 B.C.

Wild potatoes show up this early at a Chilean archaeological site; today the Mapuche people ferment them into a powerful brew.

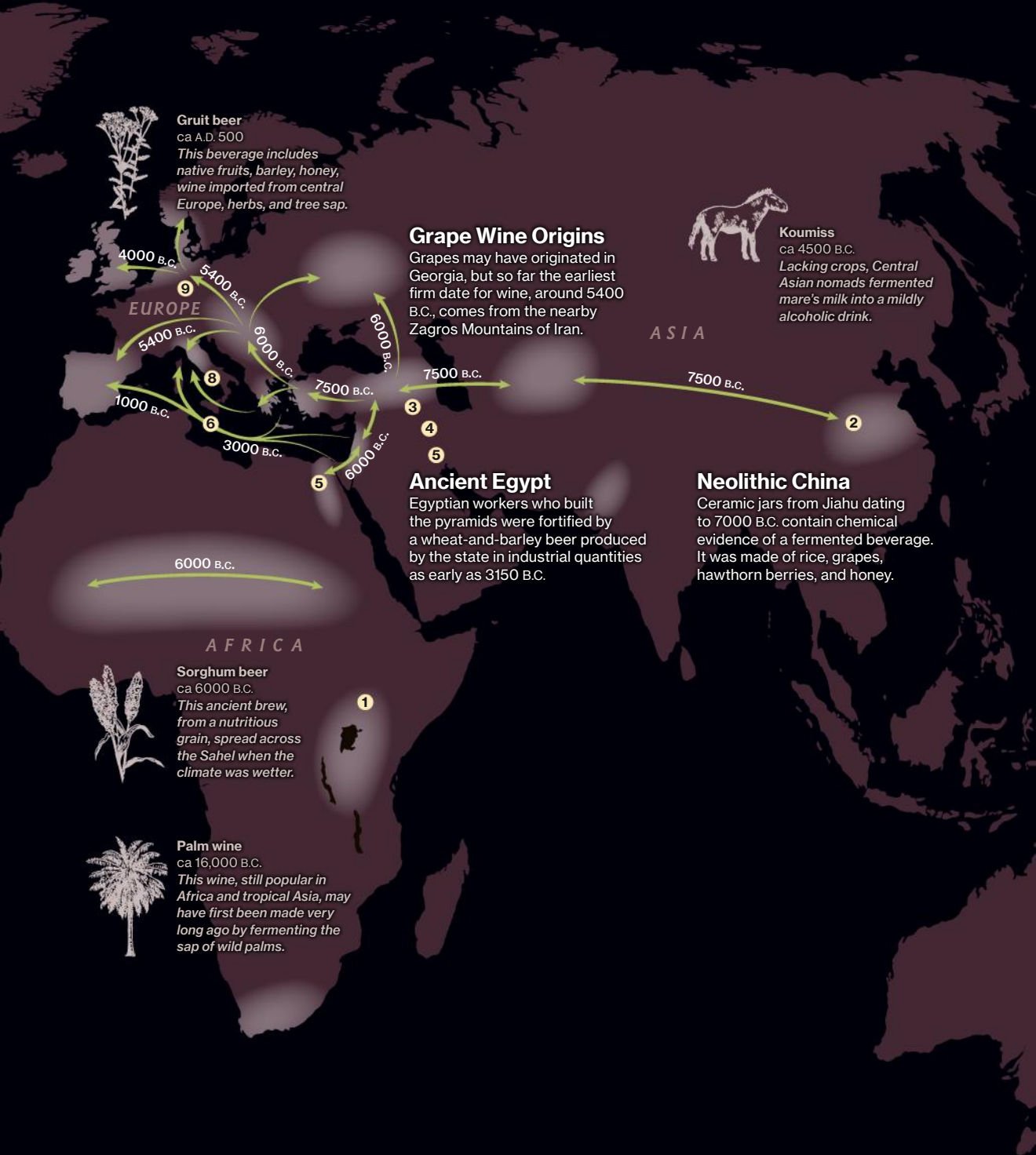
Emergence of *Homo sapiens*, who most likely consumed naturally fermented fruits

Earliest evidence of alcoholic beverages, at Jiahu, China

Earliest evidence of grape wine, at Hajji Firuz, in the Zagros Mountains of Iran

Earliest evidence of barley beer, at Godin Tepe, Iran





Mesopotamian and Egyptian civilizations emerge and introduce large-scale brewing and winemaking.

Canaanites, Phoenicians, and Greeks spread viniculture throughout the Mediterranean.

Pottery sherds indicate fermented cacao in Honduras.

Physicians in Salerno, Italy, use Arab distillation to produce first spirits in Europe.

German Beer Purity Law

Bees domesticated for honey

Since it began in 1810 as a wedding celebration for the Bavarian crown prince, Munich's Oktoberfest has grown into one of the world's largest festivals, with more than six million visitors crowding its tents each year to drain one-liter mugs of beer. Bavaria has had a big impact on beer-making: Its Reinheitsgebot, or Beer Purity Law, passed in 1516, ushered in a global trend toward uniformity by restricting brewers to water, hops, and malt (and later yeast, after it was discovered). These days some craft brewers are pushing back, experimenting with ancient additives and unusual yeasts.

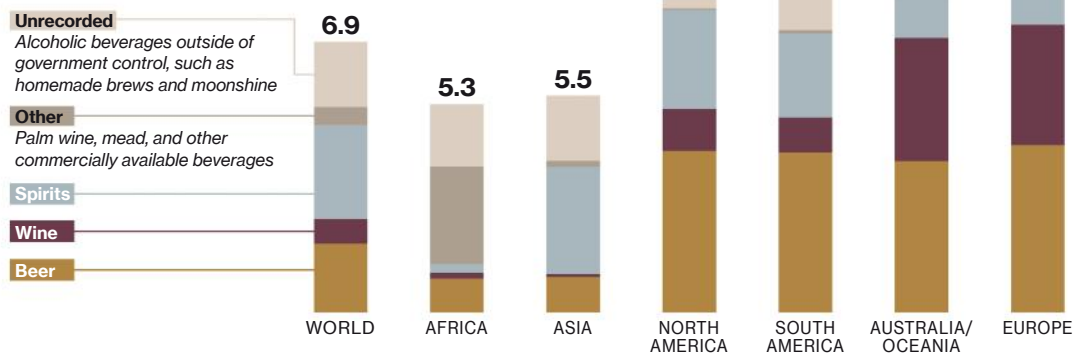




The Drinking World

People in wealthy regions with long drinking traditions, such as Europe, tend to drink the most. Abstainers are more often found in the Middle East and Southeast Asia, where laws or tradition limit consumption.

2010 per capita consumption, age 15+
Alcohol content of beverages, in quarts



JASON TREAT AND RYAN T. WILLIAMS, NGM STAFF
SOURCES: WORLD HEALTH ORGANIZATION GLOBAL HEALTH OBSERVATORY; UN POPULATION DIVISION

and regional capital. In the second and first centuries B.C. it was home to as many as 10,000 people. The town had a marketplace, a temple, taverns, a theater, and hundreds of houses.

Corent, Poux says, is a vivid example of alcohol's role as cultural glue, social lubricant, and status symbol—and inciter of violence. There's no need for sophisticated analysis to determine what the inhabitants preferred to pour. Around 140 B.C., eight decades before Julius Caesar's invasion, Corent's elites developed a ferocious taste for Roman wine. The evidence, in the shape of shattered clay wine jars, or amphorae, is so abundant that it crunches underfoot as Poux leads me across the site. Archaeologists have uncovered at least 50 tons of broken amphorae here; Poux estimates that 500 tons more remain on the hilltop.

Bending down, he plucks a palm-size chunk of fired clay flecked with black volcanic glass from the dirt and hands it to me. "We have millions of amphora sherds, all imported from Italy," he says. "This one has obsidian in it—you can tell it came from the countryside near Mount Vesuvius."

Roman vintners, whose elite Roman clients preferred white wines, tended vast plantations of red wine grapes for the Celtic market; traders moved the wine across the Mediterranean, in ships that carried up to 10,000 amphorae each, and then sent it north on small river barges. By the time it reached Corent months later, its value had multiplied a hundredfold. One contemporary claimed the thirsty Celts would trade a slave for a single jar.

Wine was the focus of elaborate rituals that cemented the status of the tribal leaders. Things often got rowdy. "The ceremonies were pompous, official—and brutal too, with sacrificial victims and sword fights breaking out over portions of meat," Poux says. "Warriors drank heavily before battle and went into battle drunk." Amphorae weren't merely opened; they were beheaded with swords. By paving their streets with the broken jars, Poux says, the rulers of Corent flaunted their wealth and power.

By his calculations, the Celts living here went through 50,000 to 100,000 wine jars over the course of a century, the equivalent of 28,000

bottles a year of expensive, imported Italian red. “And wine was primarily drunk by elites,” Poux says. “We have to assume lots more beer and mead was drunk by commoners.”

Still, by today’s standards, the quantities may not sound impressive. The modern world is awash in booze, and ever since the perfection of distillation in the Middle Ages, we’ve consumed a lot of it in concentrated form. Worldwide, people age 15 and over average about a drink a day—or more like two if you include only drinkers, because about half of us have never touched a drop. In the United States, alcohol abuse kills 88,000 Americans and costs \$249 billion a year, according to estimates by the Centers for Disease Control and Prevention.

Millions of years ago, when food was harder to come by, the attraction to ethanol and the brain chemistry that lit up to reward the discovery of fermented fruit may have been a critical survival advantage for our primate ancestors. Today those genetic and neurochemical traits may be at the root of compulsive drinking, says Robert Dudley, whose father was an alcoholic.

Throughout history, ethanol’s intoxicating power has made it an object of concern—and sometimes outright prohibition. And through the ages, says Rod Phillips, author of *Alcohol: A History*, most societies have struggled to strike a balance: “Allow people to drink because it makes them happy and is a gift from the gods, but prevent them from drinking too much.”

The ancient Greeks were a good example. A crucial part of their spiritual and intellectual life was the symposium fueled by wine—within limits. Mixing wine with water in a decorated vessel called a krater, Greek hosts served their (exclusively male) guests a first bowl for health, another for pleasure, and a third for sleep. “When this bowl is drunk up, wise guests go home,” the comic poet Eubulus warned in the fourth century B.C., according to one translation. “The fourth bowl is ours no longer, but belongs to violence; the fifth to uproar; the sixth to drunken revel; the seventh to black eyes. The eighth is the policeman’s; the ninth belongs to biliousness; and the 10th to madness and the hurling of furniture.”

A Taste of Our History

It’s been 24 hours since Zarnkow mashed together barley, bread, and milled grain in a wide-mouthed laboratory pitcher. The mixture spent the night sitting on a table next to his desk, covered by a paper plate.

When Zarnkow flicks on the lights, I can immediately see that the slop has come alive, thanks to yeast from the sourdough. Muddy sediment at the bottom of the pitcher resembles wet muesli. Every few seconds, a large bubble of carbon dioxide percolates to the top through a scummy layer of foam. A translucent gold liquid, resembling the wheat beer brewed in massive steel tanks at the brewery next door, rests in the middle.

Zarnkow says the inspiration for the brew came from a 5,000-year-old song. A hymn to Ninkasi, the Sumerian goddess of beer, it sounds a lot like the technical brewing manuals lining Zarnkow’s office shelves. “Ninkasi, when your rising bread is formed with the noble spatula, it has an aroma like from mellow honey,” one recent translation reads. “To let the fermenting vat produce loud sounds, you place it appropriately on a sublime collector vat.”

He and I look at the bubbling pitcher, in my case a little uneasily. “There’s no added carbon dioxide, no hops. It’s not filtered. It’s not to European tastes,” Zarnkow warns me, managing my expectations as he strains some Sumerian home brew through a coffee filter. “But back then, the alternative wasn’t tea or coffee or milk or juice or soft drinks. This is much more tasty than warm water filled with microorganisms.”


I pour a few fingers into a flimsy plastic cup. Bits of grain float to the top.

I take a cautious sniff.

I sip.

The beer is both tart and sweet, bready with a hint of sour apple juice at the end. It’s ... actually pretty good. If I close my eyes, I can almost imagine it changing the world. □

Photographer **Brian Finke** has shot stories for the magazine on the science of taste, food waste, and meat. **Andrew Curry**’s last feature was on Trajan’s Column in Rome. He lives in Berlin.



A California sea lion hunts for fish
on a kelp paddy at Cortes Bank,
a seamount off San Diego. It's a
trove of marine life that deserves
protection, conservationists say.

SAVING THE SEAS



President Obama added
more than 850,000
square miles of ocean
to America's network of
protected waters.
There's more to do.

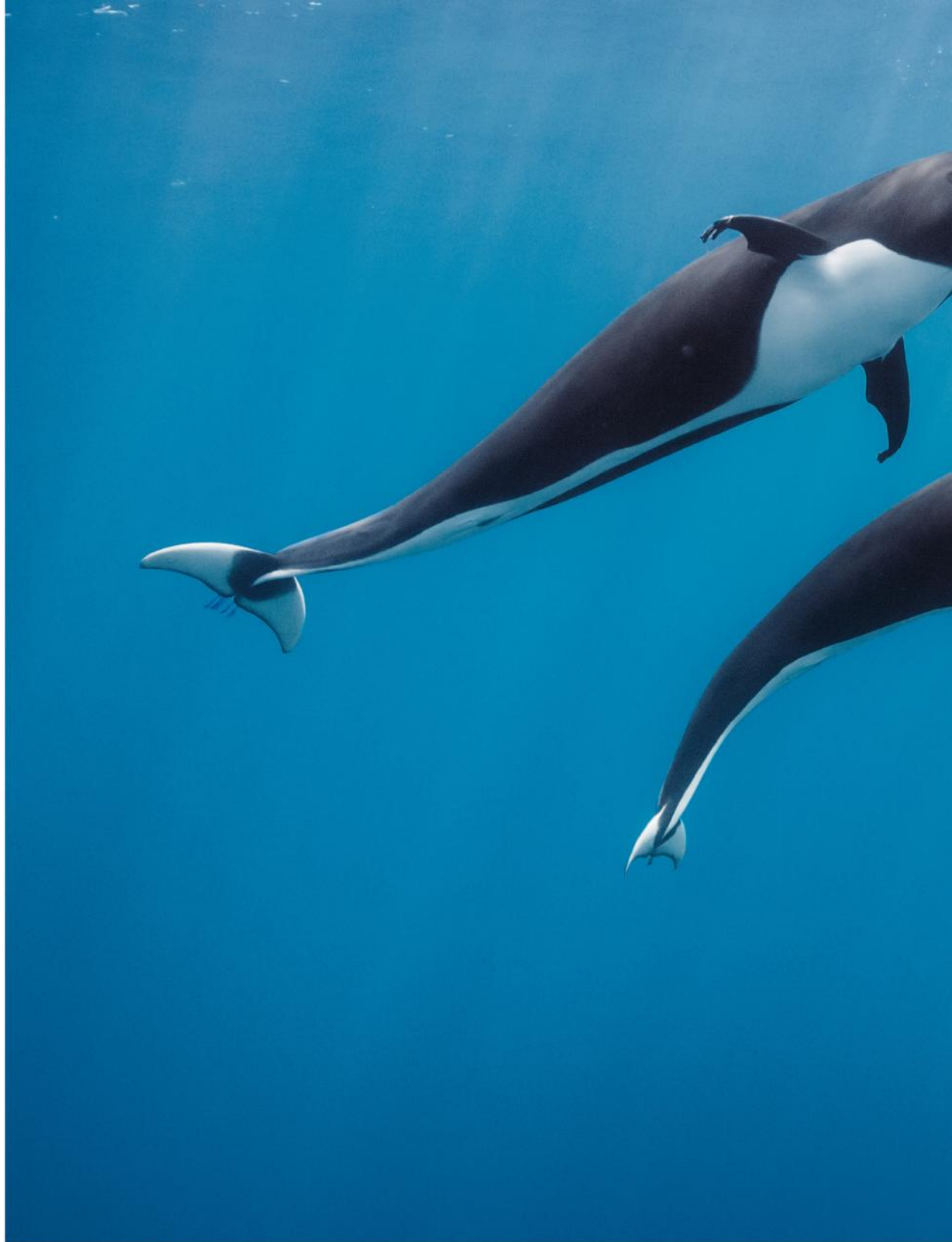


CORTES BANK

110 MILES WEST OF SAN DIEGO | PACIFIC OCEAN



A California sheephead and other fish nose through the kelp forest and coralline algae on Cortes Bank. Rising a mile off the seafloor, the seamount diverts nutrient-rich deep water to the surface, helping to create a fertile oasis.





Cortes Bank is one of the busiest gathering places for marine mammals in the world. Some three dozen species spend at least part of the year there – including these northern right whale dolphins, which typically swim in pods of a hundred or more.





A bat ray cruises through the brilliant garden of surfgrass and golden kelp along the ridge at Cortes Bank. Digging with its snout through grass or sand, it searches for mollusks, worms, and other staples of its diet.

BY CYNTHIA BARNETT
PHOTOGRAPHS BY BRIAN SKERRY

One hundred miles northeast of Boston Harbor, a half dozen endangered sei whales lunge and roll, sleek white bellies flashing in the gray North Atlantic. At the top of each lunge, they throw open tremendous, beaklike maws to strain masses of tiny copepods from the water, which gushes down the sides of their pleated throats. Off the port side of the *Plan b*, an expedition ship operated by philanthropist Ted Waitt, a school of herring chases the same crustaceans, roiling the surface. Meanwhile, on a rocky ledge 50 feet below, scientists from the ship watch pollacks, cod, and cunners feed among long ribbons of golden kelp.

Cashes Ledge is the highest undersea mountain in the Gulf of Maine—and a remarkable movable feast. As the tides wash over its granite ridges and flat-topped banks, they drive internal waves of warm surface water laden with plankton into the depths. The down-welling waves allow groundfish on the bottom to eat as lustily as fish in the middle of the water and whales, herring, and seabirds at the surface. Tides and topography have conspired here to preserve a vestige of the riches that once defined the Gulf of Maine, until fishing depleted them.

“Cashes is essentially a time machine to the coastal New England of 400 years ago,” says Jon Witman, a trim-bearded Brown University marine ecologist who has studied the hot spot for more than three decades. Oceanographer Sylvia Earle, a National Geographic explorer-in-residence, calls Cashes “the Yellowstone of the North Atlantic”—an American treasure worth saving, even if we can’t go visit in an RV.

As the oceans suffer from overfishing, pollution, and the mounting impacts of climate change, Earle is part of an effort by marine

scientists and conservationists to set aside some of the last pristine places in America’s seas. From Cashes in New England to the cold-water coral forests in the western Aleutian Islands of Alaska to the Cortes and Tanner Banks off San Diego, these advocates envision a chain of U.S. marine sanctuaries linked to a global network large enough to save and restore the oceans.

Since Theodore Roosevelt’s time, the U.S. has set aside more than 1,200 marine protected areas. They cover a quarter of all U.S. seas. But they aren’t halting the rapid decline of marine life, says Robin Kundis Craig, a University of Utah law professor and ocean specialist. In the vast majority of protected waters, at least some fishing or other resource extraction is allowed. “Are we more interested in preserving our marine resources, or are we more interested in exploiting them?” Craig asks. “We really haven’t settled this question.”

Late last summer President Barack Obama tried to settle it in two places, using his authority under the Antiquities Act, which allows the president to protect public areas that are historically or scientifically significant. First he quadrupled



TREASURE OF THE DEEP ATLANTIC

A deep-sea anemone (top); a serpent sea star attached to a sea fan; a blackbelly rose fish; a panoply of sponges, worms, and squat lobsters – these are some of the Seussian creatures that live in and around the Northeast Canyons and Seamounts Marine National Monument, created last fall by President Obama. The monument protects three deep canyons cut into the continental shelf about 130 miles southeast of Cape Cod, as well as a chain of extinct volcanoes that lies beyond the shelf in thousands of feet of water. The first marine national monument off the U.S. East Coast, it's different in a key way from parks on land: You'd need a submarine to go there.



Marianas Trench

The monument, established in 2009, protects the deepest seafloor trench in the world as well as active undersea volcanoes and hot springs.

Papahānaumokuākea

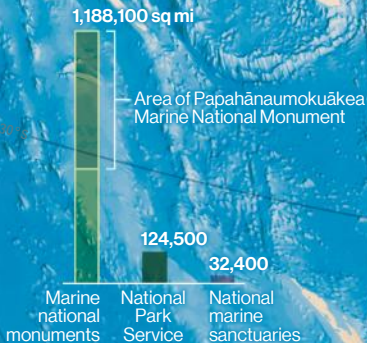
Enlarged last year to 582,578 square miles by President Obama, this monument is home to vibrant reefs and more than 7,000 marine species. Half of them, like the endangered Hawaiian monk seal, are unique to the Hawaiian Islands.

Pacific Remote Islands

This monument, created by President Bush and expanded by President Obama, protects the waters around far-flung American islands and atolls, from Wake to Jarvis. It includes dozens of seamounts believed to host many undiscovered species.

PROTECTING U.S. WATERS

U.S. marine monuments cover an area nearly 10 times as large as all the territory administered by the National Park Service—some 24 percent of the area within the 200-mile limit.



Rose Atoll

Seabirds and turtles nest on this small atoll, one of the most pristine in the world. The thriving ecosystem is home to 272 species of reef fish and many larger predators, like whitetip and blacktip reef sharks.

MATTHEW W. CHWASTYK, NGM STAFF

SOURCES: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, FISHERIES, OFFICE OF NATIONAL MARINE SANCTUARIES; NATIONAL PARK SERVICE

Shelters in a Changing Ocean

U.S. federal law provides two main ways of protecting special ocean places that lie in the exclusive economic zone, within 200 nautical miles of the coast: national monuments and national marine sanctuaries. Monuments may offer stronger shelter against overfishing and other threats. Most protected waters are in four Pacific monuments first created by President George W. Bush.

Marine Protected Areas

- Marine national monument
- National marine sanctuary
- Point of interest

0 mi 600
0 km 600

Northeast Canyons and Seamounts

The country's newest marine national monument, the first off the East Coast, protects 4,913 square miles. It includes three canyons that incise the edge of the continental shelf and four seamounts rising from the deeper waters beyond. The submerged features harbor endangered whales and turtles as well as rare deep-sea coral.



One urgent reason to protect strategic places in the sea is invisible: climate change.

the size of the Papahānaumokuākea Marine National Monument in northwestern Hawaii, to more than half a million square miles. Only recreational or subsistence fishing is allowed in the monument. It's a sanctuary for endangered blue whales and monk seals; apex predators such as tuna and sharks; and some of the world's northernmost and healthiest coral reefs, which are among the most likely to survive global warming.

Three weeks later, Obama also created the first marine monument off the U.S. East Coast, the 4,913-square-mile Northeast Canyons and Seamounts, 130 miles southeast of Cape Cod. Conservationists had proposed a much larger monument. And they had argued strongly that Cashes Ledge should be protected too. But the fishing industry opposed them on both counts. After Donald Trump's election as president, some industry spokesmen suggested that even the areas Obama did designate might be in play again. While no president has ever revoked a monument designation, the struggle to protect special places in the ocean—and the ocean as a whole—has clearly entered an urgent phase.

IT WAS HARD ENOUGH, in the 1870s, for Americans to buy into protecting “the bizarre and beautiful features of Yellowstone,” writes the park ranger-turned-author Jordan Fisher Smith. People simply didn't believe the fantastical stories from beyond the frontier of gold canyons, prismatic springs, and erupting hot geysers. The photographs of William Henry Jackson and the paintings of Thomas Moran helped make the case. Congress established the park in 1872, ensuring that America would someday be defined, as *Century* magazine editor Robert Underwood Johnson believed, as much by the landscapes it saved as by the infrastructure it built.

But persuading the public and politicians to save great seascapes presents a special challenge: While they belong to all Americans, just like parks on land, few people will ever see them in person. We can hike into the Grand Canyon, but it takes a submarine to visit the Northeast Canyons and Seamounts, along and beyond the edge of the continental shelf. Last year more than four million people visited Yellowstone, and some of them walked right up to the bison (a bad idea). But most Americans will never swim with a sei whale on Cashes other than vicariously, through the images captured by scientists and *National Geographic* photographers.

To top it off, one of the urgent reasons to protect strategic places in the sea is invisible too. Climate change has begun to compound the pollution and overfishing that have wiped out an estimated half of all commercial fish since 1970. The oceans are absorbing most of the heat caused by our carbon emissions and 30 percent of the carbon dioxide itself. Sea surface temperatures are at record highs. The water has become 30 percent more acidic since the industrial revolution.

Those changes may be invisible, but increasingly, the effects are not. The Gulf of Maine is warming faster than almost any other ocean region on Earth—and on Machias Seal Island, a popular destination for bird-watching tours, puffin chicks are starving to death by the hundreds, as their normal prey, hake and herring, avoid the tepid shallows. In southeast Florida the higher ocean temperatures have boosted the toxic algae blooms that emptied beaches and hotels last summer. And around the world, many of the largest, most colorful coral gardens have gone tombstone gray. The worst coral bleaching on record was triggered in 2014 by ocean warming caused by greenhouse gases, says C. Mark Eakin, coral reef watch coordinator for the National Oceanic and Atmospheric Administration, and then exacerbated in 2015 by El Niño.

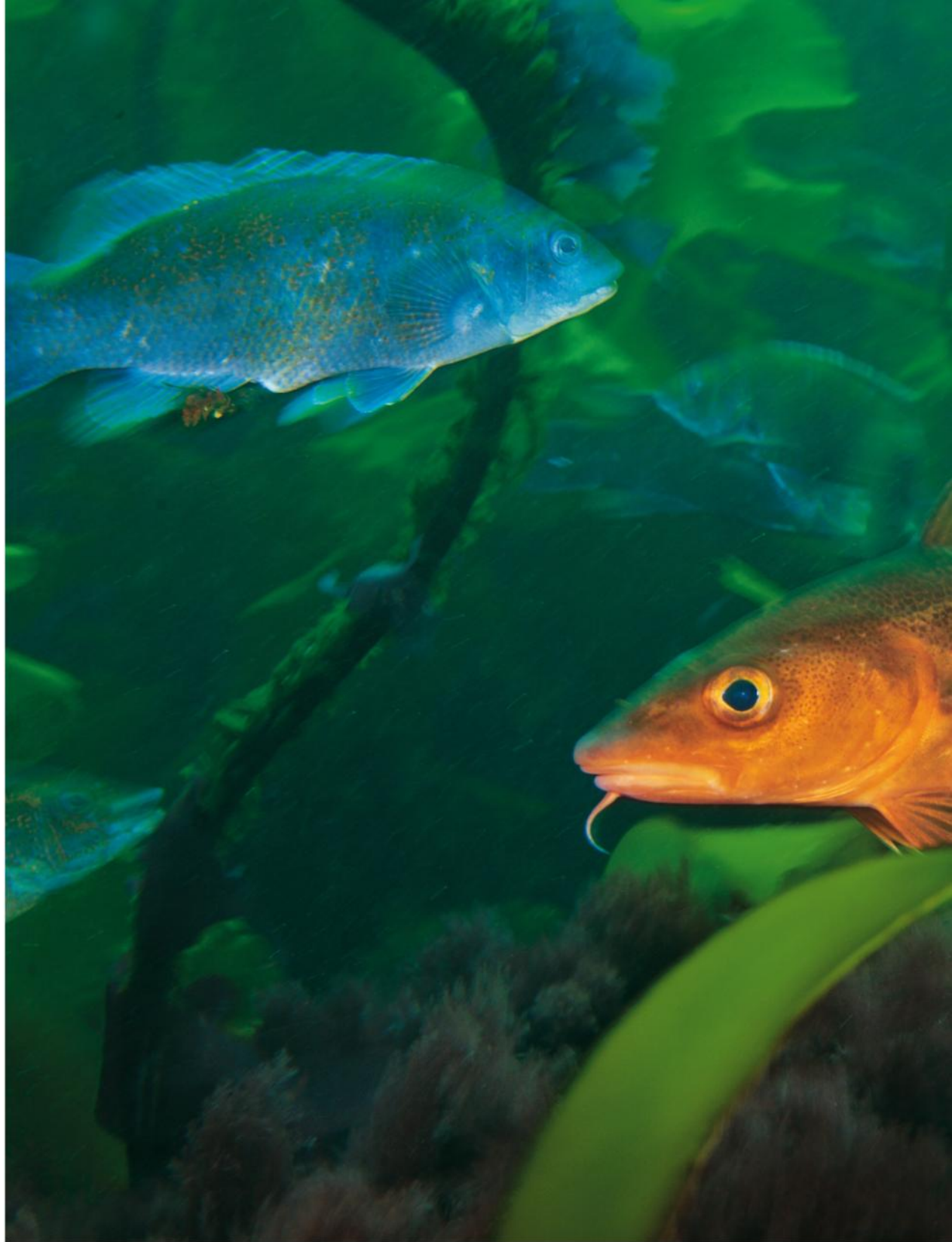
Yet the ocean is still home to treasure troves of biodiversity, and evidence is mounting that protecting such significant local areas builds resilience to climate change—and can even help regenerate what has been lost. Some of the best



A PARK BIGGER THAN TEXAS

President George W. Bush created the Papahānaumokuākea Marine National Monument in 2006, protecting the uninhabited northwestern islands of Hawaii and the sea around them. Last fall President Barack Obama quadrupled the monument's size, pushing its boundary out to the 200-mile limit of U.S. waters. A few days later, off Midway Islands, he went snorkeling there (page 76). Here are eight of the 7,000 or so species he might have encountered in one of Earth's largest protected areas on land or sea. Many fishermen have opposed the use of the Antiquities Act to designate marine monuments, but conservationists and marine scientists see it as an important means of conserving the last great places in America's seas.

Clockwise from top left: delicate sea anemone; surge wrasse; imperial nudibranch; Moorish idol; jeweled anemone hermit, hermit crab anemone, and striped anemone; leopard blenny; divided flatworm; red-tailed tropic bird



CASHES LEDGE

100 MILES NORTHEAST OF BOSTON HARBOR | GULF OF MAINE



An Atlantic cod cruises a kelp-forested peak on the highest underwater range in the Gulf of Maine. Scientists say 550-square-mile Cashes Ledge is a rare vestige of the ocean bounty that shaped New England – and a place that ought to be preserved.



proof is found in a national monument preserved half a century ago by President John F. Kennedy.

LOCATED IN THE U.S. VIRGIN ISLANDS just off St. Croix, Buck Island rises from the Caribbean in twin green hills fringed with coral pink sand. An overlook on the 176-acre island opens onto a sweeping vista of a blue-mosaic sea—and of the underwater wonder that moved President Kennedy to create Buck Island Reef National Monument in 1961. The reefs arc around the island like a necklace, their dark form easily visible between the turquoise shallows and the cobalt depths beyond.

Kennedy's focus had been to create the world's first underwater trail, where anyone might enjoy

A sei whale takes a huge gulp of water, from which its baleen will strain the copepods and other plankton. At Cashes Ledge, tide-driven internal waves carry food from the surface, where herring and seabirds feed alongside whales, to the depths where cod and other groundfish live.

what he called “one of the finest marine gardens in the Caribbean Sea.” But his 880-acre monument also included a 259-acre “no-take” area, unprecedented at the time. Buck Island was then among the most varied fisheries in the Caribbean, with a robust population of Nassau groupers. The no-take area proved too small, however. Through the 1990s, fish stocks around the island were decimated by hundreds of traps and nets. Eventually President Bill Clinton stepped in,



Protecting key areas builds resilience—and can even help restore what's been lost.

the surviving portion 90 feet landward. For more than a decade after the hurricane, the displaced reef groaned and creaked like a lost soul. Finally it attached to its new bottom and quieted down. Then in 2005, just as new elkhorns had begun to grow, a spike in ocean temperatures bleached corals in parts of the eastern Caribbean—including 80 percent of Buck Island's regrown elkhorns.

When Steneck returned to Buck Island in 2014, during an overall assessment of the reefs of the eastern Caribbean, his expectations after being away for a decade were grim. Indeed, along the northern side, enormous coral haystacks were still lifeless; diving among them was like swimming through a petrified forest. But on the southern side, Steneck got a big surprise: gorgeous young elkhorns, the healthiest he encountered among all 52 sites in his 15-island study. Living coral covered 30 percent of the southern reef, compared with an average of 18.5 percent for the greater eastern Caribbean. At Buck Island, Steneck found, large numbers of parrotfish, blue tangs, and other herbivorous fish were gobbling the algae and seaweed that can choke coral growth. And so coral cover had increased.

Parrotfish are popular eating on St. Croix; the Saturday market is full of their vivid colors. But after Clinton's expansion of the monument, managers banned all fishing—with pot, net, line, or spear—within the new limits. It was a hugely controversial decision, but one that many local fishermen now support, as Buck Island's reefs show clear signs of coming back.

While fish stocks haven't rebounded to historic levels—groupers in particular are still so rare that in six years one study counted only three of them—the fish on Buck Island's south reef today are among the most abundant and biggest in the region, according to coral reef ecologist Peter

expanding the monument to 19,015 acres.

Along with the loss of the fishery, Buck Island's reefs have been subjected to an array of other assaults. In the 1970s and '80s a deadly bout of white-band disease struck the elkhorn corals, the main reefbuilders, as central to the monument's identity as Joshua trees are to their namesake park in southern California. All but 5 percent of the elkhorns succumbed, leaving coral researchers feeling as if they were on deathwatch. "I was a coroner at that point," says Robert Steneck, a University of Maine oceanographer who has studied Buck Island since the early 1970s.

In 1989 Hurricane Hugo lashed Buck Island with 25-foot waves and 150-mile-an-hour winds, destroying part of the southern reef and flinging



BUCK ISLAND

ST. CROIX, U.S. VIRGIN ISLANDS | CARIBBEAN SEA



The protected elkhorn corals at Buck Island Reef National Monument, created by President John F. Kennedy in 1961, have staged a remarkable comeback from bleaching and disease. Here they're partially concealed by brain corals and purple sea fans.



Mumby of the University of Queensland in Australia. His research, like Steneck's, concludes that abundant fish have helped the reef recover from bleaching and disease.

"Buck Island offers hope for Caribbean reefs to be able to keep building through the end of the century—if we are very optimistic about reducing climate emissions and we combine that with strong local management of fishing and pollutants," Mumby says. "If we can manage to do both those things, our grandchildren can very well be enjoying these reefs."

The monument also benefits animals that range far outside its boundaries. In Buck Island's lagoon in summertime, it's impossible not to spot the head of a foraging green turtle popping

A leatherback sea turtle leaves the beach where she laid her eggs at Sandy Point National Wildlife Refuge, a few miles from Buck Island on St. Croix. Protected areas have helped increase hatchling numbers for leatherbacks and other turtle species—some of which remain endangered.

up from the sea grass beds, or even two heads—a mating pair. The reef is also one of the few protected feeding grounds for critically endangered hawksbill sea turtles, which feast on zoanthids, the fleshy polyps that colonize healthy corals. Two other vulnerable turtle species, loggerheads and leatherbacks, nest on Buck Island's protected beaches, along with the green turtles and hawksbills. Just as Kennedy imagined, visitors can still motor out to Buck Island, picnic on its beaches,



The Buck Island monument benefits animals that range far outside its boundaries.

CAN MARINE PARKS LIKE BUCK ISLAND help the larger ocean recover? Consider Pulley Ridge in the Gulf of Mexico, the deepest light-dependent coral reef in the continental U.S., and another place conservationists would dearly love to see designated a marine monument. Scientists believe that fish larvae born on Pulley Ridge are carried by currents around Florida's southern coast to the Florida Keys National Marine Sanctuary, where they replenish the stocks of threatened fish. If Pulley Ridge were protected, the Keys would benefit too.

At Buck Island scientists are researching the elkhorns' surprising resilience, with a view to transplanting coral colonies to climate-bleached reefs elsewhere. "These biological assets are the sources for us when we get smarter," says Zandy Hillis-Starr, chief of resource management there. If wildlife managers can help wolves and bison resurge in Yellowstone, she says, they can help sharks and groupers rebound in the sea.

Maybe they can even help cod. Back aboard the *Plan b*, marine biologist Witman is checking his GoPro footage from Cashes Ledge. In the Gulf of Maine today, the cod stock is estimated to be less than one percent of what it was in colonial times, in spite of decades of catch limits. Witman watches abundant cunners and fat pollacks sway to and fro with the waves and the kelp. For every 10 minutes of footage, he sees two or three cod swimming through. It doesn't sound impressive—but it's more than 30 times what he'd see elsewhere in the Gulf of Maine. And it makes setting aside a place where the fish can never be caught sound like a pretty sensible idea. □

and snorkel past boulder-size brain coral on the underwater trail. What they can't do is fish, anchor in the lagoon, or camp on the island.

Superintendent Joel A. Tutein was a 10-year-old boy watching from a boat when Washington dignitaries came to the island in 1962 and donned swimsuits and dive masks for the underwater dedication. He has watched various marine-protection efforts for half a century too—none more wrenching than the shutdown of the island's fishery. But in the nearly 14 years since, the community has rallied around Buck Island in ways "that pull people together instead of pulling them apart," Tutein says. Ecotourism has become an important business: Buck Island attracts around 50,000 visitors a year.

Cynthia Barnett, an environmental journalist, has written three books on water, including *Rain: A Natural and Cultural History*. She lives in Gainesville, Florida.

OBAMA'S LEGACY

Snorkeling With the President

The man who has protected more of the sea than anyone in history is entirely at ease in it. You see that right away. In September, just months before he was set to leave the White House, President Barack Obama slipped into the middle of the Pacific Ocean wearing only fins, trunks, a mask, and a snorkel. The sun shimmered on Midway Islands, a remote speck of reef halfway between California and China. A rainbow of colors from shallow mounds of coral rippled in the clear water. The sea's usual constituents were there—algae-munching surgeonfish, spectacled parrotfish, jacks, urchins.

That morning Obama had arrived on Midway's Sand Island to show off Papahānaumokuākea Marine National Monument, which his administration had just transformed into the world's largest protected area at the time, a stretch of sea more than twice the size of France. Before his swim, while ghost crabs skittered across the sand, the president strolled alongside flowering naupaka and spoke of the marine world's hold on him. He attributed his calm—what critics call his aloofness—to being born in Hawaii and “knowing what it's like to jump into the ocean and understanding what it means when you see a sea turtle in the face of a wave.” Then Obama wanted to jump in the ocean again, right there. *National Geographic* photographer Brian Skerry was invited along.

They left on boats and tied them to an orange buoy above a splash of purple rice coral. Midway is magical but not pristine. More than 5,000 people



packed its 2.4 square miles during World War II. They dredged reefs for submarines and lined them with mines. Today invasive emerald beetles flit past non-native ironwood trees that were planted as windbreaks a century ago by workers laying telegraph cable. And yet Midway feels not just wild but primal, hosting three million birds, the world's largest albatross colony, sea turtles, spinner dolphins, and rare ducks.

Obama entered a shallow sea moving with yellow-tinged butterfly fish and wrasse. Sea cucumbers stood on end because they'd recently spawned. Endangered monk seals sunned themselves nearby. Sometimes the president stood on sand near the coral to ask questions of Skerry and a guide. But just as often he moved alone,



MIDWAY ISLANDS “For a guy who is managed to the second and is always in suits and ties, being out in the middle of the ocean had to be a real treat,” says photographer Brian Skerry. He hopes this image of Barack Obama snorkeling will draw attention to ocean conservation efforts.


slowly investigating the life below him or, at times, swimming hard and fast with the fluidity of an athlete, the leader of the free world embracing a brief moment of actual freedom.

Obama gets the draw of wild places. When chafing at the straitjacket of the presidency, he spoke wistfully about a predecessor known for his conservation efforts. “Teddy Roosevelt would go up to Yellowstone Park for like a month, and

nobody knew where he was,” Obama once said. It was Roosevelt, a lifelong outdoorsman, who signed the Antiquities Act in 1906 and used it to protect the Grand Canyon, Devils Tower in Wyoming, and other majestic places, some of which later became national parks. With Congress in gridlock and the oceans pressured by overfishing, pollution, and climate change, Obama turned to the same executive authority.

At an oceans conference weeks later, Obama still seemed entranced by the Pacific. He harked back to his swim as a reminder of the seas’ resilience. “I saw it,” Obama said. “It was right there—evidence of the incredible power of nature to rebuild itself if we’re not consistently trying to tear it down.” —*Craig Welch*





Life After Loss

In some cultures, being a widow has meant exile, vulnerability, and abuse. But bereaved women are beginning to fight back.

INDIA In a shelter in Vrindavan, known as a “city of widows,” Lalita (at right) bears the cropped hair and white wrap her culture once considered obligatory for widowhood. Shelter manager Ranjana, a much younger widow, is less constrained by traditional customs.



BOSNIA AND HERZEGOVINA On the 20th anniversary of the massacre of thousands of Bosnian Muslim men in Srebrenica, Advija Zukić is shielded from the sun as she lays to rest the remains of her husband, Alaga. Forensic experts are still working to identify victims.





UGANDA Christine Namatovu and her son Andrew bring solace to each other in the house Namatovu's in-laws tried to seize when her husband died. Pushing widows off their property is common practice in this region; Namatovu, with the help of lawyers, fought back.



BY CYNTHIA GORNEY
PHOTOGRAPHS BY AMY TOENSING

1. RETURNING TO LIFE *Vrindavan, India*

Long before sunrise the widows of Vrindavan hurried along dark, unpaved alleys, trying to sidestep mud puddles and fresh cow dung. There's a certain broken sidewalk on which volunteers set out a big propane burner every morning and brew a bathtub-size vat of tea. The widows know they must arrive very early, taking their place on rag mats, lifting their sari hems from the dirt, resting elbows on their knees as they wait. If they come too late, the tea might be gone. Or the puffed rice might be running out at the next charity's spot, many alleys away. "I can't rush in the morning—I'm not well," a widow complained. "But we have to rush. You don't know what you will miss."

It was 5:30 a.m., a cool dawn, a sliver moon. A few widows had wrapped themselves in colorful saris, but most wore white, in India the surest signifier of a woman whose husband has died, perhaps recently, perhaps decades ago. In the dim light they moved like schools of fish, still hurrying together, pouring around street corners, a dozen here, two dozen there.

No one has reliably counted the number of widows in Vrindavan. Some reports estimate two or three thousand, others 10,000 or more; the city and its neighboring towns are a spiritual center, crowded with temples to the Hindu god Krishna and ashrams in which *bhajans*—devotional songs—are chanted all day long by impoverished widows who crowd side by side on the floor. The sanctity of bhajan ashrams is sustained by steady chanting, and although this

is nominally the role of pilgrims and priests, the widows earn hot meals, and perhaps nighttime sleeping mats, by singing these chants over and over, sometimes three or four hours at a time.

They live in shelters too, and in shared rental rooms, and under roadside tarps when no indoor accommodation will admit them. Vrindavan is about 100 miles south of Delhi, but the widows come here from all over India, particularly the state of West Bengal, where allegiance to Krishna is intense. Sometimes they arrive accompanied by gurus they trust. Sometimes their relatives bring them, depositing the family widow in an ashram or on a street corner and driving away.

Even relatives who don't literally drive a widow





INDIA Communities of widows in temple cities draw Hindu women from Nepal and Bangladesh as well. Bangladeshi widow Bhakti Dashi, 75, has lived for a quarter century in the back of a temple in the riverside spiritual center of Navadwip, West Bengal. Alongside others who have left home or been pushed away by their families, she sings prayers inside, for hours at a time, in exchange for her lodging and food.

from the family home can make it plain every day that her role among them has ended—that a widow in India, forever burdened by the misfortune of having outlived her husband, is “physically alive but socially dead,” in the words of Delhi psychologist Vasantha Patri, who has written about the plight of India’s widows. So, because Vrindavan is known as a “city of widows,” a possible source of hot meals and companionship and purpose, they also come alone, on buses or trains,

as they have for generations. “None of us wants to go back to our families,” a spidery woman named Kanaklata Adhikari declared in firm Bengali from her bed in the shelter room she shares with seven other widows. “We never talk to our families. We are our family.”

She sat cross-legged atop the bedsheet, even though her limbs were contorted by age and disease and she was able to walk only by bending over almost double and shuffling. Her white sari

was draped loosely over the top of her head; in India the shearing of a new widow's hair was once common practice, to announce the end of her womanly appeal, and the widow Adhikari appeared to have been recently reshorn. "I keep it this way because my hair was *his*," she said, and squinted at her guests, the foreigner and the young interpreter, as though perplexed by the question. "A barber comes and cuts it for me. A woman's greatest beauty is in her hair and her clothes. Once my husband was not there, what would I do with it?"

How old was she now? "Ninety-six."

And how old when her husband died?

"Seventeen."

I WAS IN VRINDAVAN because photographer Amy Toensing and I were visiting extraordinary communities of widows, over the course of a year, in three very different parts of the world. It was not private grieving we set out to explore, but rather the way societies can force a jarring new identity on a woman whose husband has died: pariah, exile, nuisance, martyr, prey.

When the United Nations in 2011 designated June 23 as International Widows' Day, the official explanation was a somber one: that in many cultures widows are so vulnerable—to abusive traditions, to poverty, to the aftermath of the wars that killed their husbands—that widowhood itself must be regarded as a potential human rights calamity. The women Toensing and I met, like the caseworkers and volunteers trying to help them, became our teachers in the minutiae of special cruelties. In Bosnia and Herzegovina we spent a month with one of history's singular concentrations of war widows, women who have spent two decades searching for and burying the scattered remains of more than 7,000 slaughtered men. In Uganda we learned the phrase "widow inheritance," which for Ugandans does not mean the estate a widow receives; it means that the in-laws illegally seizing all her inherited property assume they are inheriting her too, as sex partner or wife for whichever relative they choose.

And in Vrindavan, listening to a social worker named Laxmi Gautam describe with fury the

widows she has found begging because their families sent them away, we asked whether Gautam had ever imagined what she would change if she were given the power to protect women from these kinds of indignities. As it turned out, she had. "I would remove the word 'widow' from the dictionary," she said. "As soon as a woman's husband is gone, she gets this name. This word. And when it attaches, her life's troubles start."

The charitable organization of an Indian-born British business magnate, Raj Loomba, prodded the UN into sanctioning an annual widows' day. Isolation and invisibility make it hard even to figure out how many widows there are in the world; the most ambitious data gathering has come from the Loomba Foundation, which provides widows support internationally and recently estimated the total number at around 259 million, with caveats about how poorly many countries track their own widows' presence and needs. The June 23 date was Loomba's idea too. This was the day his father died in India, Loomba has written, and although more than 60 years have passed since then, the kinds of stories he tells about what happened next—his widowed mother shunned as "inauspicious" at celebratory events, marked for life as an omen of bad fortune—were repeated every day by Vrindavan women Toensing and I met.

A widow must not dress in colors or make herself pretty, because that would be inappropriate to her new role as eternally diminished mourner. A widow must eat only bland food, in small portions, because richness and spice would stir passions she should never again experience. These are fading Hindu rules, largely dismissed by educated Indians as relics of another century, but they are still taken seriously in some villages and conservative families. Meera Khanna, a Delhi writer who works for a widows' advocacy organization called Guild for Service, observes that the stigmatizing of widows comes not from the Vedas, the Hindu scriptures, but from generations of repressive tradition.

"In the Vedas nowhere is it ever said the widow has to live a life of austerity," she told me. "There's a line that says: You, woman. Why are you crying for the man who's no more? Get up,

take the hand of a living man, and start life anew.”

We planned our visits to Vrindavan, and Varanasi, a city northwest of Kolkata that also draws thousands of widows, to coincide with a simple campaign: making it possible, during celebratory festivals, for widowed women to join in. This is more subversive than it might seem. All over India the holidays of Diwali and Holi are occasions of public joy and merriment. Diwali includes gifts, bright lights, and fireworks; Holi is carried into the streets so people can “play Holi,” as Indians say, flinging brilliant powders and water at each other.

For a woman expected to live out her remaining years in muffled dignity, nothing about this kind of exuberance used to be considered acceptable. “Once you become widowed, they say you are not allowed to do any festivals,” a charity worker named Vinita Verma told me. “But we want these ladies to be a part of society. They have a full right to live their lives.”

Verma is vice president of Sulabh International, an Indian organization that provides support services and small monthly stipends to widows in shelters in Vrindavan and Varanasi. A few years ago—tentatively at first and then on a bolder scale—Sulabh began arranging Diwali and Holi events for widows in the two cities. Even in private, indoors, some of the women needed time to learn to relax among holiday flowers and Holi powders, Verma said. “They felt, ‘If I touch this red color, some bad thing will happen to me.’”

But by 2015 the holiday festivities in the “cities of widows,” as Vrindavan and Varanasi are sometimes labeled in the media, were moving purposefully outdoors. No denunciations appeared in the Indian media, and when Toensing and I were in India, the only complaint we heard about plans for the widows’ festivities was that they made for photogenic show with little substance—that what the widows really need are more comfortable lodgings, meals they don’t have to sing for, families that will take them home, communities that won’t label widowed women useless and inauspicious.

“The real change has to come from the societies that produced them,” said Gautam, the social

In many cultures widows are vulnerable to abusive traditions, to poverty, to the aftermath of wars that killed their husbands, making widowhood itself a potential human rights calamity.

worker who would like to strike “widow” from the dictionary. Gautam’s home usually houses a few widows unable to find lodging, and when I asked what labels might suit these women better, it was obvious she’d considered this before too. “Mother,” she said. “If she’s not a mother, she’s a daughter, perhaps a sister. She’s also a wife. It’s just that her husband is not alive.”

It seems important to remember too: The Vrindavan widows can be fierce. It takes stamina to chant for three hours without break, to squat on a hard temple floor, to bustle through unlit muddy streets in search of the next meal and hot tea. When I arrived, in November 2015, Diwali was about to begin, and one afternoon I followed Verma as she prepared for the Sulabh events, which would include a boisterous outdoor procession, fireworks on the river, and a thousand new saris for the widows to wear and keep as their own—in any colors they might fancy. The saris were a gift from Sulabh, and a Vrindavan store had them stacked on display; widows in the charity’s stipend program were to arrive in groups over the course of a few hours, examining and choosing as skillful Indian sari-shoppers do.

Inside the sari store my interpreter and I watched the first widows push their way toward the stack, study the saris, and summon the shopkeeper. “I like those on that other rack better,” a woman said. “Can’t we choose from those?”

No, the shopkeeper explained, those were for sale. “Humph,” a widow said. She fingered the cloth of a charity sari. “Not especially good



INDIA The exuberance of Holi, the holiday that includes flinging colored powders, was until recently thought inappropriate for widows. Aid groups, defying traditional prejudices against widows, now invite them to join celebrations like this Holi party in Vrindavan.



**To the terrible residue
left for widows of war
a new burden was added:
To rebury and mourn
the Srebrenica remains
in individual gravesites,
they would have to be
identified piece by piece.**

quality,” another widow said. “Could you *please* move over?” another widow said, and the widow she was elbowing said, Why should she—there was already enough space, and another widow said the breath of the widow beside her smelled foul, that she smoked too many bidis, the strong Indian cigarettes tied together with string. It took longer than expected to get everybody attended to, and I watched one quartet of widows walk out without new saris, harrumphing to each other. “As if our time had no value,” one said.

The Diwali procession and riverside fireworks would prove very grand, full of singing and sparklers and saris both white and colored—astonishing colors, to an outsider’s eye: sapphire, scarlet, lime, magenta, saffron. Many Indian news photographers came. Smoke swirled, fireworks lit the river pink, floating oil lamps made glowing circles in the moving water, and in spite of this my sharpest Vrindavan memory is of those four dignified widows disdaining their gift saris and marching out the door. They stayed close to each other, wrapped in widow white, chuckling, and when they stepped off the sidewalk together to cross the busy street, the traffic stopped to let them pass.

2. BURYING THE PAST

Tuzla, Bosnia and Herzegovina

WHEN THE FIRST CALL CAME from the forensic identification center, Mirsada Uzunović was home with her 13-year-old son and so willed herself to stay calm. The voice on the other end

was gentle. Remains of Uzunović’s husband, Ekrem, had been identified by laboratory testing, the voice said. The remains were...small. A partial skull. Nothing else. If Uzunović wished a burial, in the new memorial cemetery, that could be arranged.

No.

For three months she told no one. “In the nighttime, that was the difficult part. I was alone with my thoughts. From the big man I knew, only a piece of skull. I couldn’t imagine. OK, they killed him. But why didn’t they bury him? He was scattered around. I didn’t know where. *Where were those bones?* Where was he?”

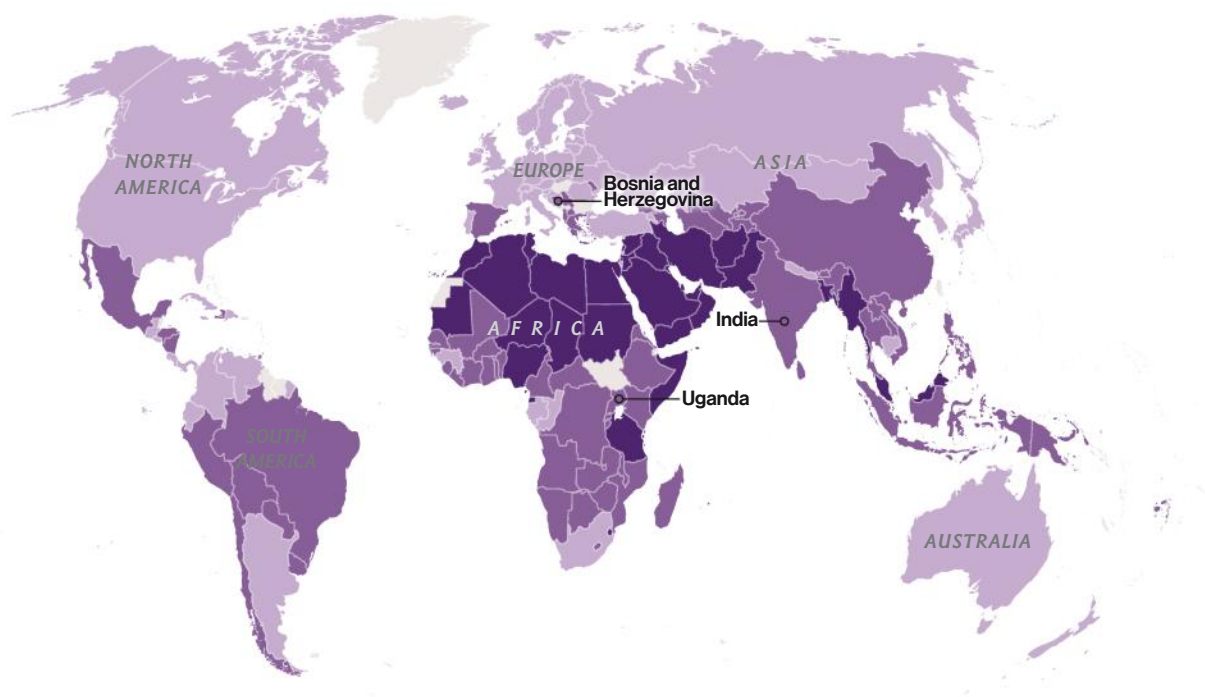
That initial call came in 2005, a decade after Bosnian Serb forces killed more than 7,000 Bosnian Muslim men—the number remains in dispute, but this is the figure on record at the International Court of Justice—during a single week of the three-year Bosnian war. From July 11 to July 19, 1995, the men were killed in and near the town of Srebrenica, on the eastern edge of the Balkan nation of Bosnia and Herzegovina. Some were forcibly separated from their families and bused to execution sites; most were shot as they tried to escape to safer Bosnian Army-held territory. Ekrem Uzunović, whom Mirsada had loved since they met at a village dance when she was 15, was wearing black trousers and a T-shirt the last time she saw him, and in his backpack carried a loaf of bread she had baked that morning. He bent down to kiss their son, turned away, and ran. He thought he might escape by hiding in the woods.

Their son was two. Ekrem was 27. In Tuzla, the city in which Uzunović and many other Srebrenica war widows were resettled, there is today a two-room office whose inside walls are covered to the ceiling with photos of dark-haired Bosnian men like Ekrem, all dead or presumed dead. Stacked albums hold thousands more, and in the photos the men are smiling or smoking or looking celebratory with drinks held out mid-toast. The photos also show boys barely in their teens and men old enough to have been Ekrem’s grandfather. Uzunović: “In every yard there was the same scene—the men running out

Widows and the Law

There are about 259 million widows, and nearly half live in poverty, according to the United Nations. Even where laws protect their rights, widows are sometimes mistreated. In parts of Africa, the Middle East, and Asia, widows can suffer discrimination, sexual assault, and the seizure of their property and children.

- Property and inheritance rights are protected by law and adequately enforced for widows and widowers.
- Equal inheritance rights are protected by law, but cultural and religious customs can override rights for widows.
- Inheritance rights are not equally guaranteed under the law, or widows have no inheritance rights.
- No data



of their houses. Women and families were crying for them, and the men didn't react or anything; they were walking toward the woods, not looking back. There was this blackness, with the forest behind it. A river of men. Yes, I have had nightmares, especially during this time of the year. After my psychotherapy it didn't get easier. But my doctor gave me pills, for July, so I can cope. I still have dreams. But it's better, because of the pills."

When we met, inside the hillside Tuzla house where Uzunović and her son still live, it was July. Every July 11, in large part because of the relentless efforts of a network of bereaved Bosnian women, a group funeral—the

coffin-by-coffin burial of remains identified during the previous year and approved by families for interment—takes place at a vast hillside cemetery established solely for the Srebrenica dead. The cemetery is in a village called Potočari, a few miles from Srebrenica; the first 600 coffins were buried in 2003, as investigators and DNA examiners were learning the full horror of what had happened to the bodies of the dead.

Now, in the first week of July 2015, the 20th anniversary was a few days away. Former U.S. president Bill Clinton was coming, Uzunović had been told, along with other international dignitaries. Uzunović was 41 now and regrettably familiar

with the cemetery in midsummer, its beautiful green undulations, its exhausting rows of headstones, its open grass for gravesites not yet dug. She had sat through many July 11 Potočari burials already: her brother, her grandfather, three uncles, four cousins, men from Ekrem's family, husbands of other widows. Every year until this one she had said not Ekrem, not yet; when the forensic center telephoned a second time, in 2007, and informed her that her husband's hip and femur bones had been identified, Uzunović had declined again to proceed with a funeral. There was still not enough of him.

"But I have been carrying such heavy baggage on my shoulders," Uzunović said to me and my interpreter, pouring thick Bosnian coffee into our cups. She had been painting a wall that morning and wore a paint-splattered sweatshirt and blue jeans, her black hair pulled into a ponytail. She looked drained and composed. "I've waited too long," Uzunović said. "I need to close the chapter. I cannot wait anymore." This year, at the Potočari ceremonies, she would bury her husband.

IN BOSNIAN THE WORD for widows is *udovice*. In the names of the collaborative organizations they built, though, the Bosnian war's female bereaved are called *žene*, women. Snaga Žene, for example: Women Power. During that 1995 summer, people passing the Tuzla sports center could spot at once the Srebrenica *žene* who had been removed to Tuzla by the truckload while their husbands, sons, brothers, and fathers were being shot. Men had said: When I escape, I will get to the sports center; meet me there—and for weeks women kept standing just outside, hoping. "It was unimaginable for them," Snaga Žene's president, Branka Antić-Štauber, a Tuzla physician, told me. "To realize the scope, that this huge of a number of people had been killed over just a few days. And then the parts, from individuals, began to be found in separate graves. That was unimaginable for everybody."

Bosnian Serb leaders, worried that the mass graves would be discovered, ordered thousands of corpses dug up and reburied around the countryside. Earthmoving equipment, disinterring

and hauling and dumping, broke the decomposing bodies apart. Thus to the terrible residue traditionally left for widows in the world's conflict zones—trauma, rape, isolation, financial destitution—a new burden was added: The Srebrenica remains, if they were to be reburied and mourned at individual gravesites, would have to be identified piece by piece.

The forensic detection, the exhaustive matching of bones and fragments to DNA samples from relatives, has been the work of a post-Bosnian war organization called the International Commission on Missing Persons. The demands for an accounting—the push for a single special cemetery; the hunt for photos





BOSNIA A small building in Tuzla houses the Women of Srebrenica group, which continues to demand an accounting of the men slaughtered by Bosnian Serb forces during one week of the Bosnian war. Founder Hajra Čatić, whose husband and son were killed in the 1995 massacre, sinks back in exhaustion during preparations for the anniversary commemoration. Behind her: faces of the dead and those still missing.

of all the missing; the monthly street protests to insist that each man's remains be found, the killers prosecuted, and the word "genocide" attached forever to the Srebrenica killings—have been the work of the women. "I have to say they're all heroes," Amra Begić, an official at the Srebrenica-Potočari memorial center, told me the day before the 20th-anniversary funeral. "We didn't know what strong women our mothers are."

Begić's father and grandfather were among the

victims; two headstones mark their graves. There were 6,241 finished graves before this latest delivery of the dead. The new green coffins now lined up inside the memorial center—in Islam green is a sacred color—numbered 136. The remains of Ekrem Uzunović lay in coffin 59, and on the cloudless warm morning of the funeral Mirsada Uzunović found the headstone with his name, the freshly dug grave. The relatives with her had brought folding chairs, and for a while she sat on



BOSNIA Best friends from childhood, married to brothers killed in the Bosnian war, Fata Lemeš (at left) and Hamida Lemeš now live and garden with four other war widows in the village of Skejići. "This beautiful landscape," Fata says, "actually brought so much evil."



one and received people politely, their embraces, their murmured sympathies. From a dignitaries' tent too far away for her to see clearly, Clinton's voice could be made out faintly, but Uzunović didn't understand the English and was not especially interested. The voices changed, the prayers and intonations kept coming, and there was a moment of noisy rage when the Serbian prime minister, in attendance at a July 11 ceremony for the first time, tried to place flowers on a random headstone and was whistled and jeered so menacingly that his bodyguards hustled him to a waiting car.

An imam pleaded for respect. The cemetery went silent. The first of the green coffins could be glimpsed down below, borne by pallbearers; the imam called for prayer for the fallen, and thousands of people together on the hillsides bent simultaneously. Uzunović did not pray. She got off her chair, lit a cigarette, sat on the ground by the empty hole in the earth, and waited. Let the others pray, she thought. She had said so many prayers already, and it was Ekrem she needed to address: You told me to keep our son safe. Look, he is 22 years old. He is a university student. He is helping to carry your coffin. He will help lower it into the ground and shovel the dirt on top, and then, finally, you will have a place.

3. ENFORCING THE LAW

Mukono District, Uganda

"THE HUMBLE PETITION of Tumushabe Clare Glorious sheweth as follows." In Uganda legal documents are composed in flowery, colonial-era English, and on a midsummer morning an attorney named Diana Angwech balanced two thick files on her lap, thumbing pages, reviewing. The improvised courtroom was a small red building between a corn patch and a stand of banana trees, an hour's drive from the capital, Kampala. Inside, on the concrete floor, a few wooden benches faced the magistrate's desk, which atop its clean surface displayed only a calendar, a Quran, and an old Bible held together with string.

A guard at the door stepped aside, and the people came in, filling the benches beside and behind Angwech. The widow Clare Tumushabe carried

her two-year-old daughter, the youngest of her six children, and sat down in the fourth row. Tumushabe had once been a more timid woman, but her head was now high as she studied the courtroom around her; she had been pregnant with this daughter when her husband died—a sharp headache, a hospital unable to revive him—and she was learning how to speak with clarity and passion about what happened to her next.

She was summoned—mourning, pregnant—to a meeting of important members of her deceased husband's family and clan. They informed her that the children now belonged not to her but to them; directed her to keep her hands off all crops on the household plot, as they also were no longer hers; and presented to her the brother-in-law—her husband's oldest sibling, 20 years Tumushabe's senior—who would move into the home at once and take her as the third of his wives.

The house and three acres Tumushabe's husband had inherited from his father must pass wholly to them, the in-laws said. As the widow, Tumushabe, by tradition, was essentially part of the property, like the coffee bushes and the jackfruit trees.

Tumushabe told them this was nonsense. She said she would never take this man into her bed, that her husband had left papers proving the land passed to her. The in-laws said she had apparently bewitched and stupefied her husband and that she might want to see just how much help he would be to her now, from that freshly dug grave in which he lay. Tumushabe summoned police. She harvested some crops and chopped trees for firewood. Threats escalated; epithets were directed at the children. One day a man from her husband's family appeared on the property shouting that today Tumushabe would die, and because Tumushabe's hand was cut during the encounter by a panga—a broad-bladed African machete—Diana Angwech had an assault charge with which to haul one of Tumushabe's tormentors into court.

You work with what the situation brings you, Angwech and her colleagues kept reminding us, as Toensing and I followed them through their rounds in villages of central Uganda: You

commiserate, you counsel, you try to enlighten police officers and village elders, you visit community forums to explain that bullying a new widow into giving over her family property is prohibited even when the bullies are her own in-laws. “People were in shock—‘Oh my God, this is actually wrong?’” said a lawyer named Nina Asimwe, recalling the first public talks she gave after joining other Ugandan professionals in the Kampala office of International Justice Mission (IJM), the organization that employs Angwech. “They thought it was normal. An injustice, but normal. OK’d by society.”

Think of these Ugandans as a widows’ defense brigade: attorneys, social workers, and criminal investigators using their nation’s own justice system to undo long-held assumptions about women who have lost their husbands. IJM is a U.S.-based nonprofit that supports legal advocacy in other countries for impoverished victims of violent abuse, and in one sense the agenda of its employees in Kampala is modest. They operate a pilot program, within one large, mostly rural district east of the capital, that provides free lawyers and caseworkers for victims of a crime known throughout eastern and southern Africa as “property grabbing”—extorting vulnerable people, by verbal threats or physical attacks, into giving up possession of land that is rightfully theirs.

For reasons both ancient and modern, widowed women are the most frequent victims of property grabbing in this region of the world. More than two-thirds of Uganda’s 39 million people raise at least some of their own food, and holding title to one’s own home and attached land remains a powerful assurance of material security: meals for the children, firewood for cooking, crops to sell at market. Because graves are often placed near the home, the person in charge of the family property also possesses ancestral history, honor, status. And the rapid growth of Uganda’s population, along with the arrival of mortgage banking, are pushing up the value of land. A house and the cropland around it now constitute potential loan collateral for business investments or the accumulation of more land.

These are things traditional Ugandan culture

The Ugandan widow was told that her children belonged to her late husband’s family, that her home and crops were no longer hers, and that she would become her brother-in-law’s third wife.

does not easily concede to a widow. The constitution, rewritten in 1995 and a source of national pride, promises gender equality. Modern statutes explicitly extend inheritance rights to wives and female children. But in practice, especially in the rural areas that make up most of Uganda, it’s still widely assumed that only men should own or inherit land, that widowhood terminates a woman’s social legitimacy, and that it’s up to her husband’s family and clan to decide what happens next—who will take the property, who will take the children, who will have sex with her now. “Plus the stigma,” Asimwe said. “If you’re a widow, bad luck. You’re cursed. You’re blamed for the death of your spouse. It could be that he had several homes, several wives, that he brought HIV into the house. But when he dies, it’s you. You killed him.”

So with widows as their clients, IJM advocates in the villages and courtrooms of Uganda’s Mukono District have an audacious goal: to broadcast across Mukono, and perhaps throughout Uganda and beyond, the idea that seizing these women’s homes and crops—as well as the assaults, threats, forgeries, and verbal abuse this often entails—is not only wrong but punishable by the courts. Diplomacy is crucial; in village meetings Asimwe always addresses her elders as “my fathers” and “my mothers.” She tells them she knows widow abuse is typically treated as a family dispute to be worked out among clan leaders or by village councils, whose elected heads command respect.

But their efforts are often inadequate, she



UGANDA A week after her husband's death, Solome Sekimuli, 54, defiantly fills the doorway of the Luwero District home they shared. Weapon-brandishing relatives from his side – who forced their way in on the funeral day – have tried to wrest away the property by force.





UGANDA When widows turn to the law to battle abuse and property grabbing, the odds against them can be formidable. Archivist Michael Nyero works in the records room of the Mengo Chief Magistrate Court, one of many local courts overwhelmed by backlogs.



insists, and council heads can be bought off or threatened. In Luganda, the primary indigenous language of the area, she uses blunt words: *okubba*, stealing, and *kimenya mateeka*, criminal. She implores her listeners to remember the likely future for a widow who is chased from her home by panga-brandishing property grabbers: Her birth family may not take her back, because they can't afford to or no longer regard her as one of them. Such a widow may be left to the streets, perhaps forced into prostitution. "Then of course the society around them is going to face a problem of insecurity," Asimwe said. "The children will become street children. People who used to eat three times a day are going to eat once a day. Malnutrition will come into play."

The buy-in is slow. A former national police officer who now directs IJM's Mukono District investigations said his policing friends were initially perplexed as he began heading into village constabularies, teaching officers to gather property-grabbing evidence and take seriously threats of violence against widows who try to fight back. Colleagues of his generation would raise an eyebrow, he told us: "What is the issue here? Is this an important matter?"

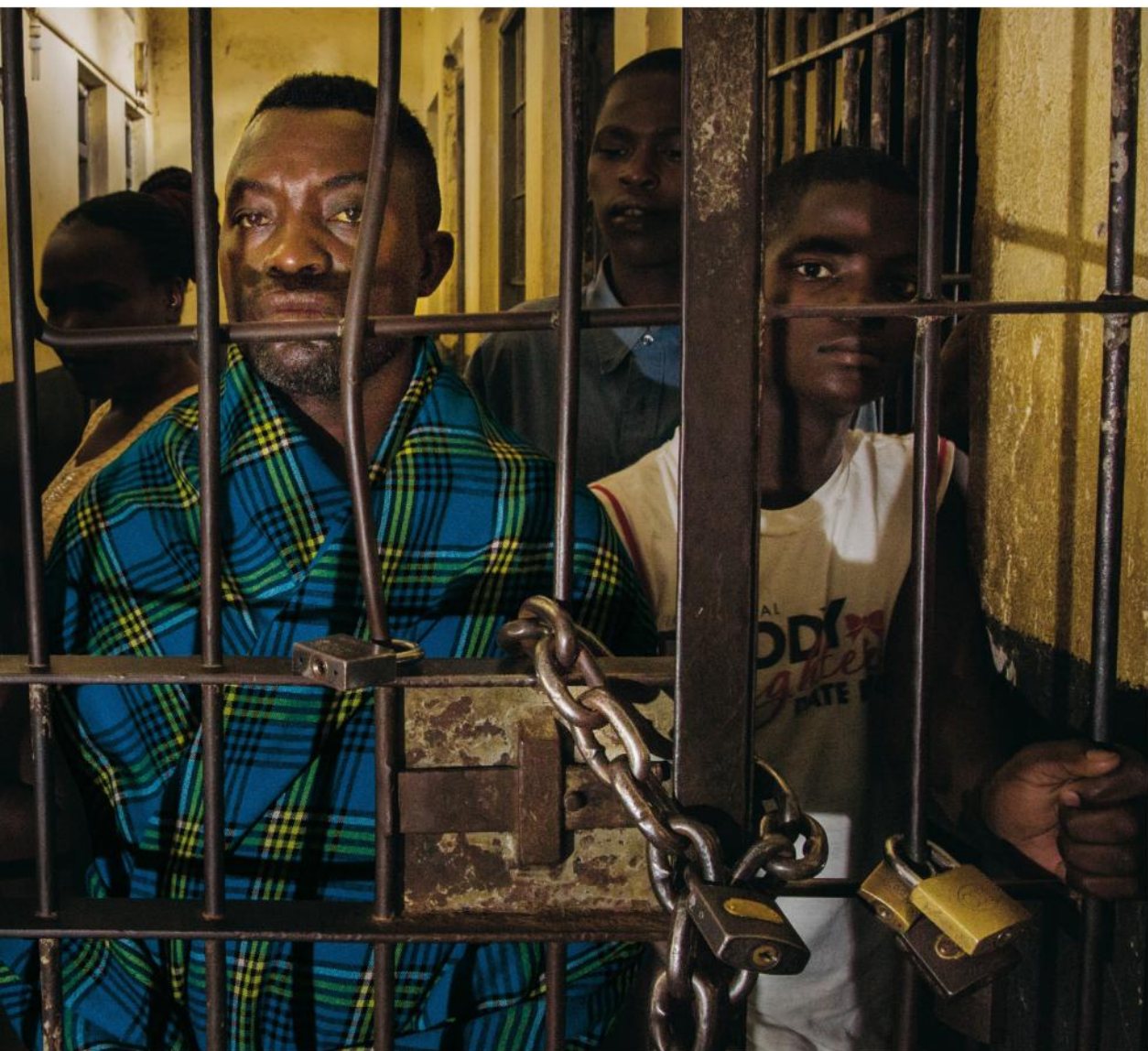
The threats are so credible and widespread, in fact, that they are sometimes directed at case investigators, which is why IJM asked that this investigator's name not be published. And the cases themselves can be enormously complex. Uganda sanctions multiple ways to possess land, both precolonial and modern, so it can be hard to prove who held ownership rights even before the husband died. Ugandans are wary of wills, such obvious portents of death. Cohabitation relationships are common, even though those aren't legal marriages; many women who regard themselves as wives turn out not to be, for inheritance purposes. "But I believe that there is hope," lawyer and casework director Alice Muhairwe Mparana told Toensing and me last June. "We are not 100 percent there, but we have begun the work. We already have nine convictions this year."

Some of the charges that stuck during the first half of 2016: unlawful eviction, criminal trespass, intermeddling, which means impermissibly



interfering with someone else's business matters. There is no law in Uganda, or anywhere else, making it criminal to treat a widow as though her life no longer has value. But June 23 marked the sixth International Widows' Day, and in the biggest town in Mukono, a grassy square facing the courthouse was given over to a special commemoration, with microphones, a uniformed band, hundreds of folding chairs, and a tented seating area roped off, as the signpost read, for "Honoured Widows." Important people rose to speak: the police chief, for example; and the head magistrate; and Clare Glorious Tumushabe, who took more time at the microphone than any of them.

With help, Tumushabe said, she had remained



UGANDA Joseph Ssenkima (at center), accused of terrorizing a Mukono District widow named Betty Nanozi, is believed to be one of more than 70 people who destroyed her crops and threatened her son's life. Since Nanozi's husband died, members of his family and their allies have tried to drive her from the home he willed to her. Police working with International Justice Mission pursued suspects for weeks.

on her family property. "I only loved one man," she shouted in Luganda, her voice rising like a preacher's, and the Honoured Widows cheered. "I said to my husband's clan, 'How would you give me to another man? I didn't get married to a whole clan.'"

Three months later Toensing and I got the news: The man who attacked Tumushabe had been convicted of "assault occasioning actual bodily harm" and was commencing his yearlong

sentence in jail. Tumushabe and the lawyers were exultant. But his siblings were furious, and the lead investigator was worried about the widow and her children. "We have beefed up security for her," he said. "And we have looked into going to the community, to sensitize them. She's isolated where she lives. But she is tough and strong." □

The Pulitzer Center on Crisis Reporting provided a grant to support this story.

Shadow Cats

Eclipsed by their larger cousins, the world's small wildcats deserve their day in the sun.

CARACAL

Consummate predators, some small wildcats can take down larger prey. The caracal of Asia and Africa is less than two feet tall but has been filmed leaping over nine-foot fences to prey on sheep.

Caracal caracal, photographed at Columbus Zoo and Aquarium, Ohio





PALLAS'S CAT

A famously grumpy expression made this Central Asian species an Internet star. Conservationists hope the cat's celebrity will help save its habitat from encroaching farms and other threats.

Otocolobus manul, at Columbus Zoo and Aquarium





By Christine Dell'Amore
Photographs by Joel Sartore

‘S he’s very close,” Germán Garrote whispers, pointing to a handheld receiver picking up Helena’s signal. Somewhere in this olive grove beside a busy highway in southern Spain, the Iberian lynx and her two cubs are probably watching us. If it weren’t for her radio collar, we’d never know that one of the world’s rarest cats is crouching among the neat rows of trees. At five years old Helena has learned to meld invisibly into the human landscape, even hiding with her newborns in a vacant house during a raucous Holy Week fiesta.

“Ten years ago we couldn’t imagine the lynx would be breeding in a habitat like this,” says Garrote, a biologist with the Life+Iberlince project, a government-led group of more than 20 organizations working to bring the spotted predator back to the Iberian Peninsula. Standing in the scorching heat with traffic rushing at our backs, he tells me that the cat’s future is to live in fragmented areas. “Lynx have more ecological plasticity than we thought,” he says.

Indeed, the amber-eyed, bushy-bearded feline has finally started to land on its feet after decades of decline. When Iberlince stepped in to rescue the lynx in 2002, fewer than a hundred of the cats were scattered throughout the Mediterranean scrubland, their numbers chipped away by hunting and a virus that nearly erased the region’s European rabbits, the lynx’s staple food. The lynx population was so depleted that it was suffering from dangerously low genetic diversity,

making it vulnerable to disease and birth defects.

Luckily for the scientists, lynx breed well in captivity, and 176 have been reintroduced into carefully selected habitats since 2010. Four breeding centers and one zoo raised most of the cats, all of which were outfitted with tracking collars. Sixty percent of the reintroduced lynx have survived, and a few have surpassed expectations.

Two lynx made “a spectacular trip across the whole Iberian Peninsula,” each walking more than 1,500 miles to new territory, says biologist Miguel Simón, director of the reintroduction program. The team works closely with private landowners to earn their trust and persuade them to welcome lynx on their property. In 2012, when





the population hit 313—about half of which were old enough to breed—the International Union for Conservation of Nature upgraded the lynx’s status from critically endangered to endangered.

Not far from the olive grove, I duck thankfully into the coolness of a drainage tunnel that runs under the highway. Cars and trucks are the leading killers of lynx, so Simón and his team are working with the government to widen these tunnels into wildlife underpasses. Simón crouches, pointing to animal tracks in the sand. One belongs to a badger, he says, but the other is a paw print—a lynx! Helena could have trotted through here minutes ago.

Back in the sun, I ask Simón what the Spanish think of their native cat. He pauses, surprised at

IBERIAN LYNX

One of the world’s rarest cats, the Iberian lynx is slowly increasing in number as scientists release captive-raised cats and boost populations of rabbits, the lynx’s staple food.

Lynx pardinus, at Madrid Zoo and Aquarium, Spain

the question. Everyone knows the Iberian lynx, he tells me. It’s a beloved national figure.

That’s not the case for most of the lynx’s relatives. Of the world’s 38 wildcat species, 31 are considered small cats. Ranging in size from the three-pound rusty-spotted cat to the 50-pound Eurasian lynx, they inhabit five of the world’s seven continents (excluding Australia and

Antarctica) and are superbly adapted to an array of natural—and increasingly unnatural—environments, from deserts to rain forests to city parks. Unfortunately, these lesser members of the family Felidae also live in the long shadow cast by their larger cousins, the big cats: lions, tigers, leopards, jaguars, and their kin. These celebrity species attract the lion's share of attention and conservation dollars, even though 12 of the world's 18 most threatened wild felids are small cats.

Jim Sanderson, a small-cat expert and program manager at the Texas-based Global Wildlife Conservation, estimates that more than 99 percent of funds spent on wild felids since 2009 have gone to help jaguars, tigers, and other large cats. As a result, many small cats are vastly understudied or not studied at all. Their skill at eluding attention also contributes to their obscurity.

The rarely seen bay cat, for example, is native only to the forests of Borneo and remains as opaque to science as it was in 1858, the year of its discovery. All that's known of Southeast Asia's marbled cat comes from a study of a single female in Thailand. "We have no idea what it eats," Sanderson says.

Small cats suffer another disadvantage: people's tendency to view them as simply wild versions of their own pets. (The domestic cat—considered a subspecies of the wildcat—evolved from wildcats in the Fertile Crescent about 10,000 years ago.) The public isn't as "awe-inspired" by small cats as by more exotic beasts, says Alexander Sliwa, a curator at Germany's Cologne Zoo. "This perpetuates the situation that little is known about smaller cats, and if you can't tell people about a cat's biology or lifestyle, then people are not hooked."

They should be. Small cats are lean feats of evolution, high-performance predators that hit their stride millions of years ago and have changed little ever since. What they lack in stature, they make up for in grit. The black-footed cat, for

example, is the smallest cat in Africa, weighing less than five pounds. But it's nicknamed the ant-hill tiger because it lives in abandoned termite mounds and fights tooth and claw if threatened, even jumping in the face of the much larger jackal. The resourceful fishing cat of South Asia is a denizen of swamps and wetlands but can scratch out a living wherever fish are found. Cameras in downtown Colombo, Sri Lanka, once caught a fishing cat stealing koi from an office fishpond. It was a "shocker to all of us," says Anya Ratnayaka, the primary researcher at the Urban Fishing Cat Conservation Project. "There's not a wetland anywhere near this place."

Small wildcats have adopted other clever ways to coexist. In Suriname, Sanderson and his colleagues photographed five cat species living in the same rain forest: jaguar, puma, ocelot, margay, and jaguarundi. They do this by "dividing space and time," he says. Each animal has its niche, whether it's hunting on the ground during the day, like the jaguarundi, or hunting in the trees at night, like the margay.

Though some small cats are capable of killing goats and sheep, they pose no threat to humans. On the contrary, as predators often at the top of their food chain, they help keep ecosystems running smoothly and prey populations—including many rodents—in check.

OF THE FIVE CONTINENTS roamed by wildcats, Asia has the most to lose. Not only is it home to the greatest number of small-cat species—14—it's also where the animals are least understood and under the greatest threat.

Much of Southeast Asia's forestland has been developed or turned into sprawling plantations for palm oil, a common food ingredient whose production has doubled worldwide since 2000. This is likely devastating for the flat-headed cat and the fishing cat, both animals that typically rely on lowland wetlands for the fish they eat.

The spread of palm oil plantations is such a concern that Le Parc des Félins, a zoological park outside Paris that houses the most species of small cats in the world, has put two shopping carts on display—one filled with products made



PHOTOARK
JOEL SARTORE

Photo Ark is a joint project of National Geographic and Joel Sartore. Learn more at natgeophotoark.org.



ATLANTIC
OCEAN

Lynx on the Brink

Widespread throughout Spain and Portugal at the turn of the 20th century, the lynx became critically endangered as disease and development led to loss of its prey and habitat.



with palm oil, the other with products that don't have it. The items in both carts—ice cream, cookies, cereal—look basically the same.

"We don't ask people to donate money but to eat less palm oil," says Aurélie Roudel, an educator at the leafy, 175-acre park.

Another threat facing small cats is the illegal wildlife trade, particularly poaching for skins, furs, and other animal parts, Roudel says. China is a hub for such criminal activities. In large cities merchants sell clothing and gloves made from the skins of small cats. In the 1980s China exported the skins of hundreds of thousands of leopard cats, a species that ranges throughout Asia. Though demand for skins has dropped considerably, leopard cats in China are still hunted and killed for preying on domestic animals.

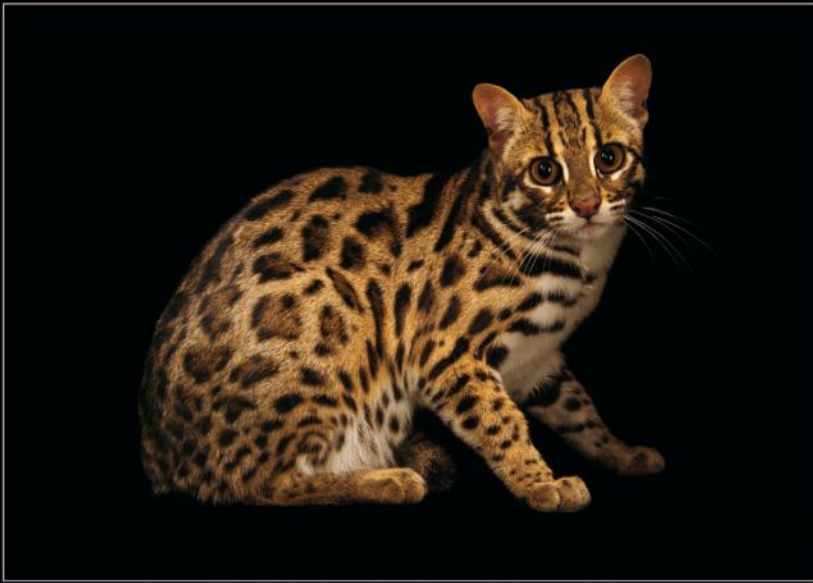
Leopard cats, I soon discover, are impressive enough creatures on their own. On this drizzly June day, most of the French park's residents are huddled in their boxes, but the two leopard cats are out and about, their coats a glossy tapestry of brown and black. One balances expertly on a log, licking its front paw, while the other chews tall blades of grass, reminding me of my Maine coon cat back home.

Then I check myself, remembering what Alexander Sliwa, the Cologne Zoo curator, had said: Small cats are very different from house cats, particularly because they're always on the go. The black-footed cat, for instance, can walk nearly 20 miles and eat one-fifth of its body weight in food every night. Unlike Fluffy on the couch, "it cannot afford to lie around."

Neither can conservationists, who've begun to lift some species out of obscurity in hopes of saving them. In 2016 they launched an international effort to study and save Central Asia's Pallas's cat, a species in decline but largely hidden in the shadow of the famous snow leopard.

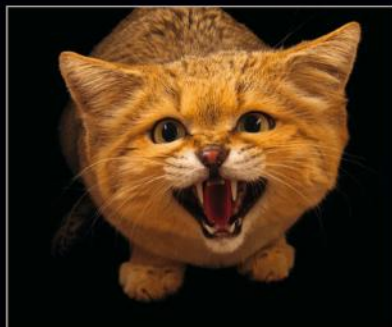
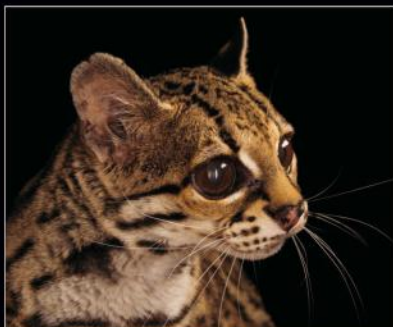
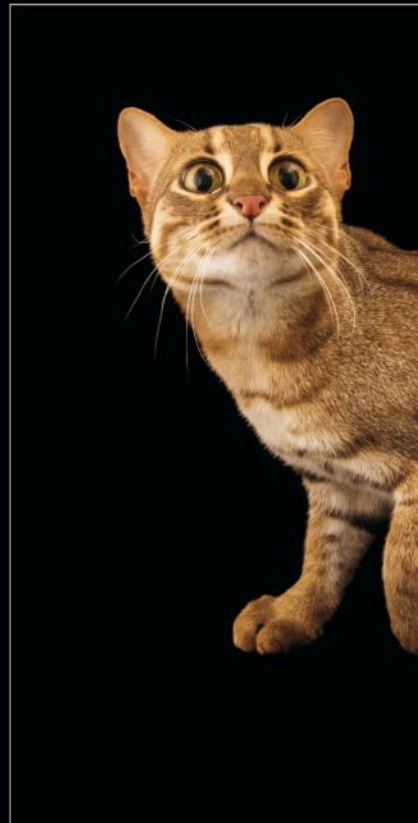
"A lot of our work is putting the Pallas's cat on the map," says David Barclay, coordinator of the European Endangered Species Programme for the Pallas's Cat. He's got some help, thanks to the cat-crazy Internet. The round, fluffy feline has become a hit online because of its grumpy expression and its odd manner of scuttling about its mountainous home. Though people are "laughing their way through the videos," Barclay says, "they're becoming subconsciously aware."

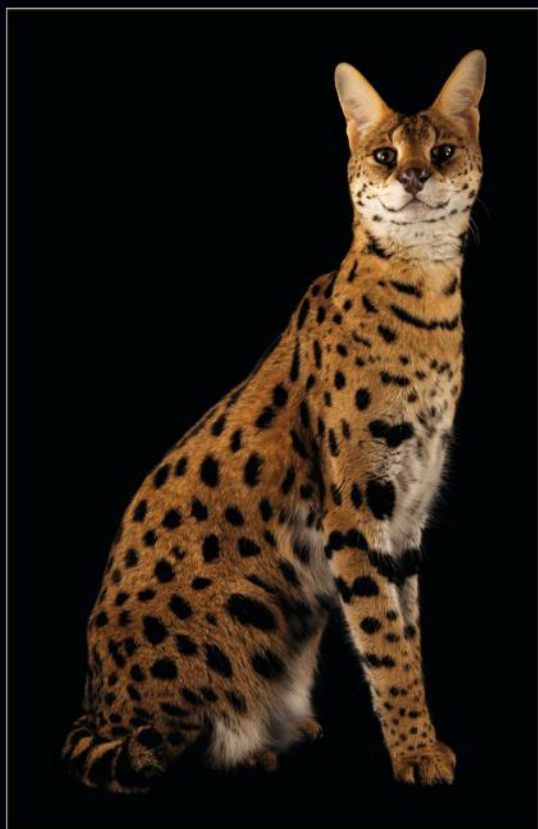
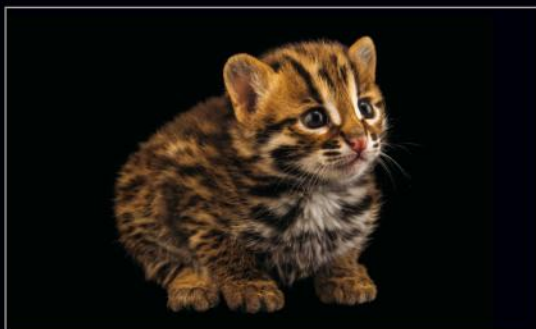
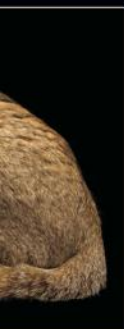
A long-term conservation program in Japan has stabilized the population of the Iriomote cat,

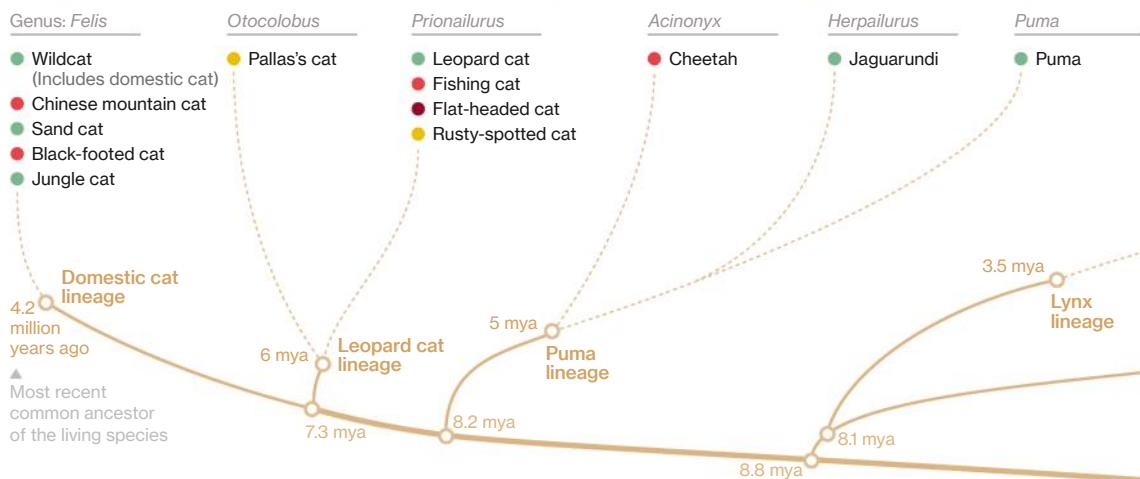
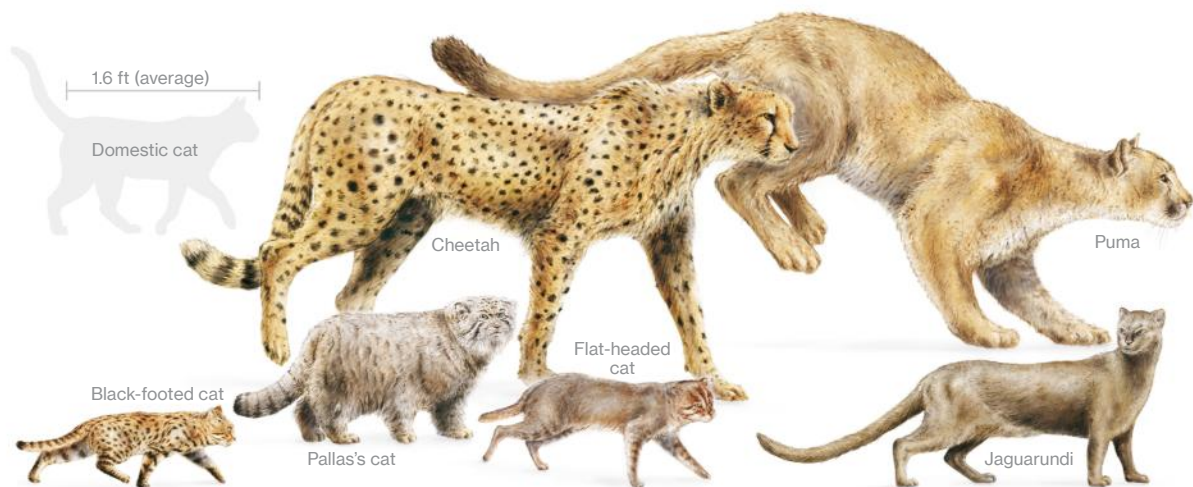


Shy and rarely seen, the world's small wildcats are experts at avoiding attention. Most remain little studied and get scant support.

Top row: leopard cat, jaguarundi, melanistic (black) Asiatic golden cat
 Middle row: Asiatic wildcat, leopard cat, Geoffroy's cat
 Below: African wildcat
 Bottom row: margay, sand cat, rusty-spotted cat, serval







Small Cats in the Spotlight

Advances in genotyping and sequencing reveal that Earth's 31 small cat species hail from seven distinct lineages, each named for the first discovered species in the line. While modern cheetahs and pumas are large in size, they are genetically more closely related to small felines.

a critically endangered subspecies of the leopard cat that lives only on Iriomote Island. Cartoon cats plaster the sides of buses, and the animal even has a brand of sake named in its honor.

And in Spain's Sierra de Andújar Natural Park, near where Helena and her fellow lynx live, eco-tourism involving lynx-watching has sprung up in recent years alongside rabbit and deer hunting, traditional mainstays of southern Spain.

"We are business partners," Luis Ramón Barrios Cáceres, owner of the Los Pinos resort, says of the lynx, laughing. "They pay the bills." Lynx-watching tour groups often base their operations at the country hotel, whose gift shop brims with tchotchkes inspired by the local star.

On the nearby San Fernando Ranch, Pedro

López Fernández allows both rabbit hunters (when rabbit numbers are plentiful) and lynx on his nearly 700-acre property. López, whose family has ranched in the region for four generations, is clearly proud of his land, where cows wander hilly forests of holm oak and cork, accented with blooms of pink oleander.

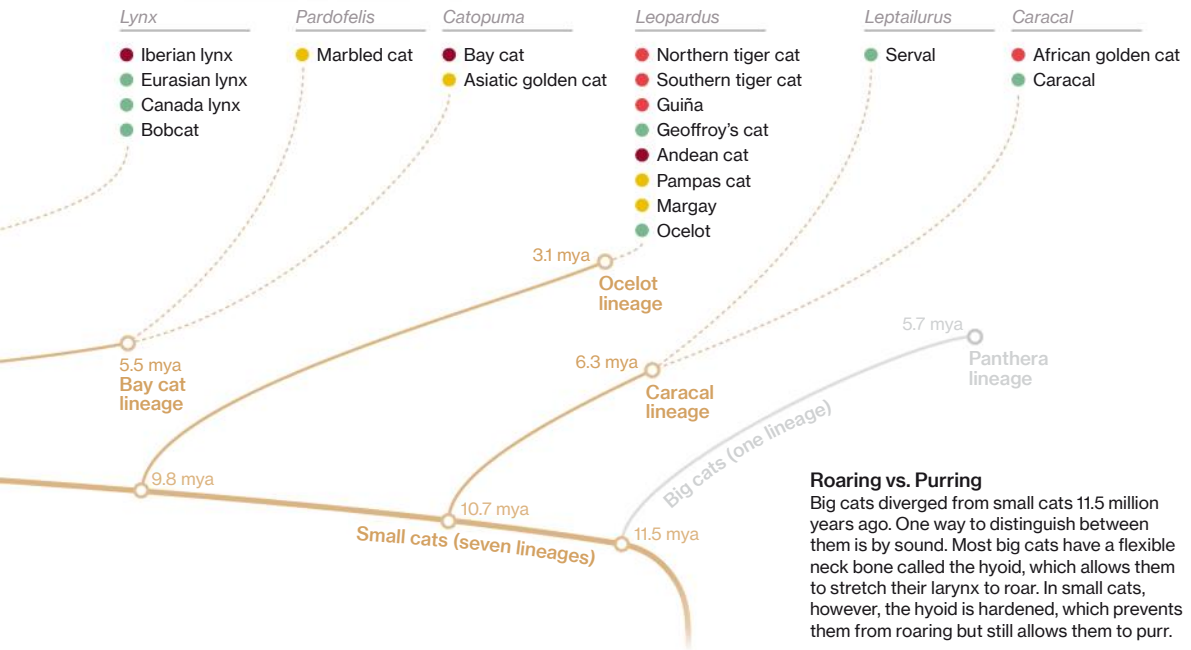
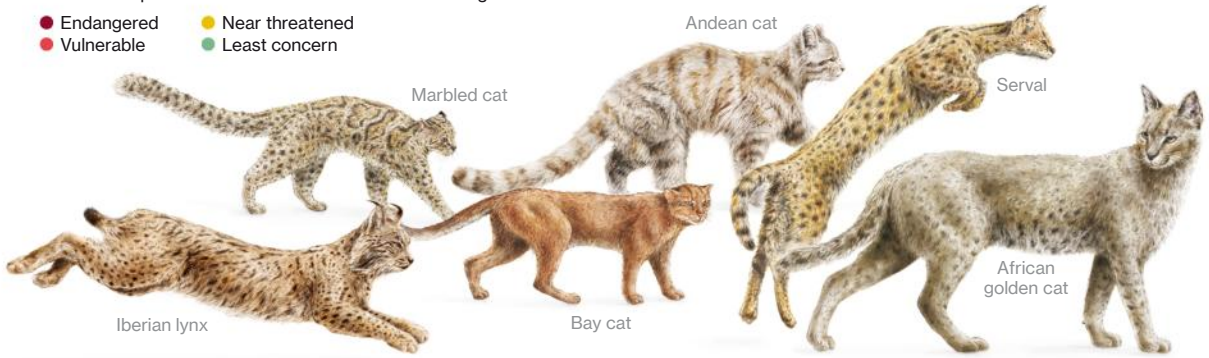
The lynx is "one of the most valuable species, because it only comes from here," López tells me. Not all landowners agree that the cats should be protected. Some are wary of government interference and don't want lynx on their land. But López believes that the lynx is part of Spain's heritage and the country should make sure it thrives.

At La Olivilla Breeding Center in Santa Elena,

How Are Small Cats Faring?

Many small cats have adapted well to their changing environments, but several species are considered vulnerable or endangered.

- Endangered
- Vulnerable
- Near threatened
- Least concern



scientists are working around the clock to do just that. Sitting in front of an array of computer monitors, keepers record behaviors of their 41 Iberian lynx on the hour, 24/7. On this hot afternoon, the animals—a mix of breeding females, cubs, and juveniles being readied for reintroduction—are mostly resting indoors.

The center's veterinarian, María José Pérez, explains the painstaking lengths taken to prepare young lynx for release into the wild: surrounding their enclosures with black barriers so they don't see people, feeding them rabbits through vegetation-covered tubes, scaring them with horns so they learn to fear cars. "I feel privileged to contribute to the lynx not going extinct," Pérez says.

At his desk, keeper Antonio Esteban clicks over

to a video feed of a mother lynx and her four cubs sprawled on the ground, paws tucked close to their tiny faces. Someday these animals will be crucial to the survival of their species. But for now they're doing what felines do best: taking a catnap. □

Christine Dell'Amore, natural history editor for National Geographic's website, enjoys spending time with her own small cat in Washington, D.C.

Gallery on previous pages: leopard cat, *Prionailurus bengalensis*, at Angkor Centre for Conservation of Biodiversity, Cambodia; jaguarundi, *Herpailurus yagouaroundi*, at Bear Creek Feline Center, Florida; Asiatic golden cat, *Catopuma temminckii*, at Assam State Zoo, India; Asiatic wildcat, *Felis silvestris ornata*, at Omaha's Henry Doorly Zoo and Aquarium; leopard cat, *Prionailurus bengalensis*, at Angkor Centre for Conservation of Biodiversity; Geoffroy's cat, *Leopardus geoffroyi*, at Cincinnati Zoo and Botanical Garden; African wildcat, *Felis silvestris lybica*, at Omaha Zoo's Wildlife Safari Park; margay, *Leopardus wiedii*, at Cincinnati Zoo and Botanical Garden; sand cat, *Felis margarita*, at Chattanooga Zoo; rusty-spotted cat, *Prionailurus rubiginosus*, at Exmoor Zoo, England; serval, *Leptailurus serval*, at Fort Worth Zoo.



AFRICAN GOLDEN CAT

Inhabiting the rain forests of West and Central Africa, this species is threatened by forest loss and bush-meat hunters. This seven-year-old male, Tigri, is likely the only cat of its kind in captivity.

Caracal aurata, at Parc Assango, Libreville, Gabon



MARBLED CAT

A supersize tail likely helps this house-cat-size species balance as it navigates the forests of Southeast Asia at night. Due largely to its secretive lifestyle, it is one of the least known small wildcats.

Pardofelis marmorata, at private zoo





| PROOF | A PHOTOGRAPHER'S JOURNAL

Modern Amazonia

In the jungle today, real people face the clash of tribal lore and modern lure.





Living in a makeshift camp near Dourados, Brazil, the indigenous Guaraní-Kaiowá people have lost much of their ancestral land to industrial farming and ranching. Some of their efforts to reclaim the long-disputed area have been met with violence.



In Tipishca, Peru — a rainy, remote village near the Curaray River — houses are built on stilts to keep water out. Locals have seen a spike in traffic and pollution on the river since oil companies appeared in the area.



Story and Photographs
by Yann Gross

Noble savages, lost cities, pristine wilderness—Amazonia has always conjured romantic myths and stereotypes. But what is the jungle really like in the 21st century? In 2011 I set out to find the answer.

My interest actually began in 2008, when I was working with an indigenous community to reforest a patch of northeastern Brazil. The youngsters in the village liked to talk about the purity of tribal life, but it was a borrowed nostalgia. Like most kids their age, they danced, drank, and played soccer. One evening they refused to take me to a party; I wasn't dressed well enough. At that moment I realized how much our perceptions and projections can differ from reality.

After that I started to read books about Amazonia. One of them was an account of the Spanish soldier Francisco de Orellana's voyage down the Amazon River in the 1540s—the first European exploration of the region (but not, of course, the last). I decided to follow in the footsteps of that expedition, to see what the route is like today.

Starting in the Ecuadorian Andes, I slowly made my way downriver. For six weeks I traveled through the Peruvian Amazon on a medical boat from Peru's navy. I arrived in Colombia, and finally Brazil, where I picked up the Trans-Amazon Highway. Access was often tricky, and usually expensive. I did a lot of research just to find routes that would work.

As I traveled, I photographed staged scenes of the people and places I encountered. I didn't look for unspoiled nature or uncontacted tribes; I collaborated directly with local communities. In one of them, in Brazil, I shot a video clip for some indigenous rappers. Later I went back to their village and led a one-month video workshop. Good relationships with local people help me create meaningful work.

I hope this project reveals how ambiguous and complicated modern Amazonia really is. Many people there today aren't indigenous; they're there for economic reasons. Not all of them are against development. Once you have some comfort, it's hard to go backward. □







Ancient beliefs still hold sway in Amazonia. Snakes – like this stuffed rainbow boa (left) wearing a merchant's festive kerchief at a market in Iquitos, Peru – appear in the myths of many local cultures. In Santo Tomás, Peru, fantastical and demonic masks help young members of the Cocama people reconnect with their ancestral heritage.





A shaman's medicinal garden in Zábalo, Ecuador, is used to treat some of the indigenous Cofán people. But many in the tribe have traded the healing properties of plants for medicines manufactured by the pharmaceutical industry.





Amazonia is home to millions of species, including humans and rodents. Just outside the forest, in Guaiviry, Brazil, Dulcídio Gomes (left) entertains children by pairing traditional garb with a Batman mask. In Buena Vista, Peru, a paca – a type of forest rodent prized for its tender meat – is kept as a pet but will soon be a meal.

Xapuri, Brazil, has grown in recent years. But with no bridge to span its namesake river, a ferry is still the best way to get across. Like other parts of Amazonia, the region has withstood centuries of “progress”: rubber and roadbuilding booms; gold, oil, and timber quests; and evangelical Christian missions.





FURTHER

A GLIMPSE OF WHAT'S NEW AND NEXT

EYES IN THE SKY

By Jeremy Berlin

Want to take a cosmic Rorschach test? Tilt your head to the side. If you see a pair of bright eyes in the inky depths of space, you're seeing what a team of astronomers spied last year—a rare formation created by the grazing collision of two spiral galaxies.

Galactic sideswipes aren't unusual, says lead researcher Michele Kaufman. What is novel are the shapes they can create. Here, the gravitational pull of NGC 2207 (top) produces tides in its companion, IC 2163—as the moon does on Earth. Gas and stars from the edges of IC 2163 then race inward before abruptly slowing down, forming two “eyelids.”

A telescope in Chile called the Atacama Large Millimeter/submillimeter Array, or ALMA, helped Kaufman and her team see what computers had modeled. “As soon as I saw this data in high resolution,” she says, “I realized it showed us for the first time how an eyelid structure develops.”

Of course, the reason we perceive these shapes as eyes in the first place has nothing to do with telescopes. It's due to pareidolia—a psychological phenomenon in which we see familiar shapes where none exist. The celestial eyes on this page are 114 million light-years from Earth. Technology and psychology will determine what else pops into view.

In this image the blue represents data from the Hubble Space Telescope; the red is carbon monoxide visualized by ALMA.

PHOTO: M. KAUFMAN, ALMA (ESO/NAOJ/NRAO); NASA/ESA HUBBLE SPACE TELESCOPE

A SUMMER THEY'LL NEVER FORGET



Our trips for high school and middle school students offer the ultimate opportunity to follow in the footsteps of National Geographic explorers. We invite students to join us this summer in incredible places across the globe to work alongside National Geographic scientists and explorers, learn photography from the pros, get involved in community service, experience life on a college campus, and more. On our trips, students travel with purpose, exploring through the lens of important topics—from wildlife conservation to archaeology.

Australia • Ecuador & the Galápagos • Tanzania • Belize • Bhutan • Yellowstone • Madagascar • Thailand • and many more!

 **NATIONAL GEOGRAPHIC**
student EXPEDITIONS

Call toll-free 1-877-877-8759 or visit ngstudentexpeditions.com/ourtrips

© 2017 National Geographic Partners, LLC. NATIONAL GEOGRAPHIC STUDENT EXPEDITIONS and the Yellow Border Design are trademarks of the National Geographic Society, used under license.



**IT'S THE
DRY FOOD
HE'S BEEN
WAITING FOR.**

**TENDER,
MEATY MORSELS**

**TASTY,
CRUNCHY KIBBLE**

We've created an entirely new kind of dry cat food,
featuring two unique textures to appeal to your cat's appetite.

Introducing **Purina ONE® Tender Selects Blend.**

REAL MEAT #1 | 0% FILLERS MEANS EVERY INGREDIENT HAS A PURPOSE

Lifelong Whole Body Health Starts with ONE
purinaone.com/tender-selects

